SUMIX corporation

Megapixel Gigabit Ethernet CMOS

CAMERA

User Guide

SMX-12A2x Series Gigabit Ethernet Cameras

SMX-12A2x Series Gigabit Ethernet Cameras User Guide

Revision 3.1

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Chapter 1

INTRODUCTION

The **SMX-12A2x Series** cameras are 2.1 megapixel CMOS cameras with the Gigabit Ethernet interface and Full HD 1080/60p resolution (1920 x 1080). The high speed and full HDTV resolution makes the cameras suitable for digital cinematography, surveillance and industrial applications.

The SMX-12A2x Series cameras are available in two models:

- color SMX-12A2C
- monochrome SMX-12A2M.

The SMX-12A2x Series cameras have the following characteristics:

- High Efficiency Microlens Array
- RGB Color Filter Array (for SMX-12A2C)
- Electronic Focal Plane Rolling Shutter
- Progressive Readout with Rolling Shutter
- Green Responsivity (550nm): >5000 LSB/lx-s
- Patented Low-Noise, High-Speed Video Architecture
- Frame Rate up to 60 fps progressive, with maximum sensor resolution
- Output Bayer Raw Data 12 and 8 bit per pixel
- Extended Sensitivity 60 fps at 1280 x 720 (2/3 inch)
- 120 fps at 1280 x 720 (1/2 inch)
- Variable Electronic Shutter:
  - Synchronizable to External Shutter/Flash
  - Synchronizable to External Frame Synchronization clocks
- Dynamic Noise Reduction (DNR)
- Vertical Line-Mixing including 3->2, 2->1, 3->1 and 4->1 Modes
- Horizontal Pixel-Binning including 1.5->1, 2->1, 3->1 and 4->1 Modes
- Enhanced Sensitivity 2/3-inch Video Using Pixel Binning and/or Line Mixing
- Video Gain from -24 up to 72 dB; independent control of R, G and B channels (for SMX-12A2C)
- Sub-Sampling Modes Optionally Provide 1.5x, 2x, 3x or 4x lower resolution
- Windowing with 16 Column and 9 Row Resolution

- Gigabit Ethernet full duplex mode Interface
- Ethernet cable length up to 100 m
- Power Over Ethernet (PoE) IEEE 802.3af compliant or external power: 5 V (500 mA)
- Hardware image processing (Gamma, brightness, contrast, median filter, lossless image compression)
- Hardware Conversion Table from 11 bits (12 bits output with >11 bits dynamic range) to 8 bit per pixel
- Hardware lookup table separately for R, G and B colors

Chapter 2

Installation and Update

Before installing the SMX-12A2x camera, make sure that your computer has a Gigabit Ethernet Adapter (see "How to Determine Gigabit Ethernet Connection" on page 65)

System Requirements

Operating System	XP SP1+/2003/Vista/2008/7, recommended: Windows 7 or XP SP1 and higher
Processor	Intel Core 2 Duo, recommended: 2 GHz or higher
Performance	Minimum 400 Mflops, recommended: 500 Mflops or higher
Memory	256 MP for XP (512 MB for 2008/Vista/7), recommended: 512 MB (1024 MB)
Video Card	Video chipset: ATI 9X series (or higher) or NVidia GeForce 4x (or higher), up to date Video card drivers
Hardware Interface	At least one free Gigabit Ethernet port for connection, recommended: Intel 1000 Pro PCI-Express adapters

Step1: Installing Camera Software

To install the SMX-12A2x camera application software:

1. Run the **SMX12A2-<version>.exe** file downloaded via the URL provided by Sumix Corporation.
2. **Welcome to the SMX-12A2 Gigabit Camera Software Setup Wizard** starts. The wizard will guide you through the software and hardware drivers installation. Close all other applications that are running on your computer and then click the **Next** button to continue the installation.

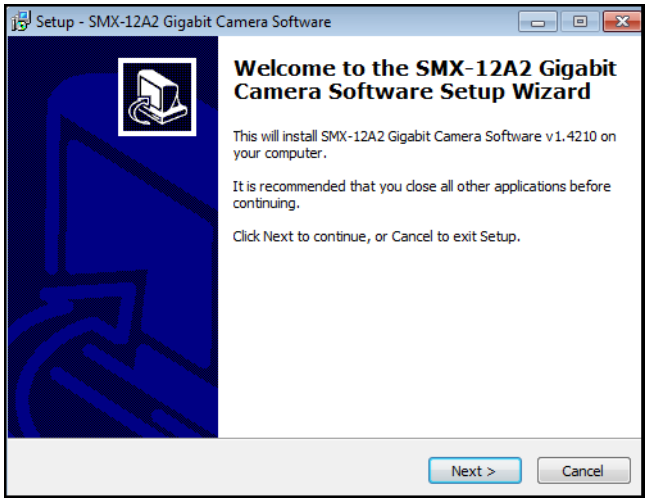


Figure 2-1 *Welcome to the SMX-12A2 Camera Setup Wizard box*

3 In the **License Agreement** box, read the license. Then select **I accept the agreement** and click **Next**.

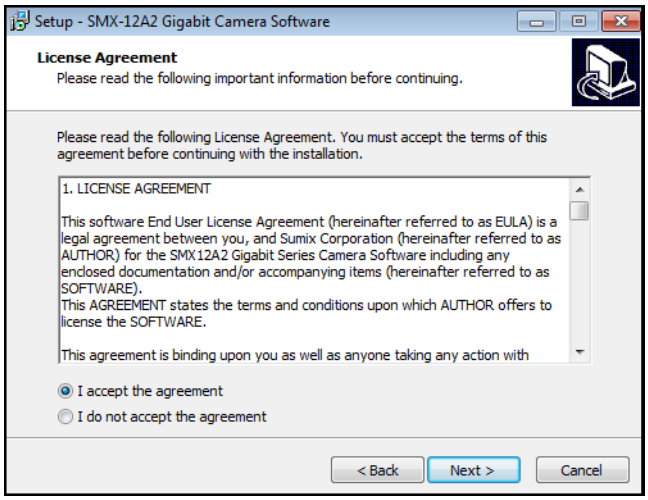


Figure 2-2 *License Agreement dialog box*

4 The wizard starts to check your system information. Upon completion, a table with check results is displayed in the **System Information** box.

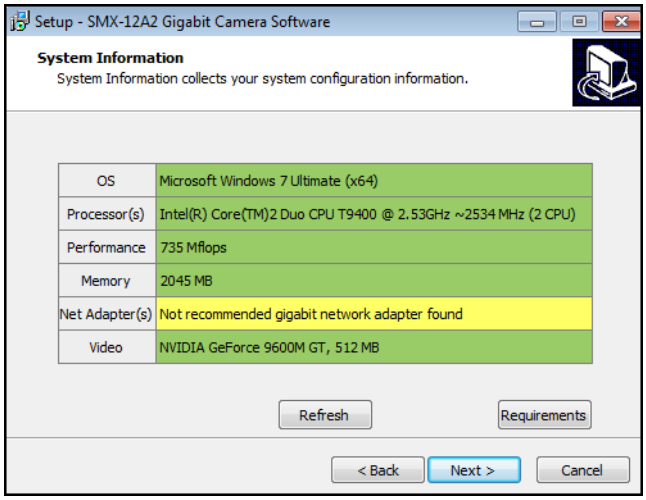


Figure 2-3 *System Information box*

5 Do one of the following, depending on the results of the check:

- click the **Next** button if all table cells with system parameters are green (the parameters satisfy the software requirements)
- update your system if at least one cell is red - such configuration is not recommended
- update your system if at least one cell is yellow, otherwise the technical characteristics declared for the camera will not be achieved.

To see the recommended system requirements, click the **Requirements** button in the **System Information** dialog box:

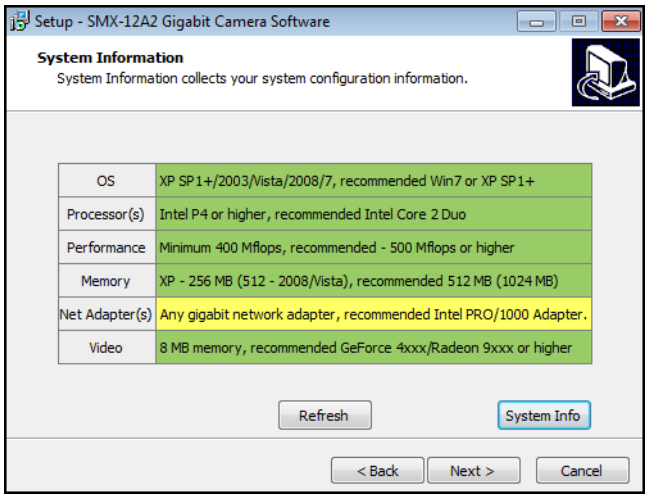


Figure 2-4 *Recommended system configuration*

6 In the **Select Destination Location** box, click **Browse** to change the folder in which the SMX-12A2x camera application software will be installed, or leave the one suggested by the wizard. Click **Next**.

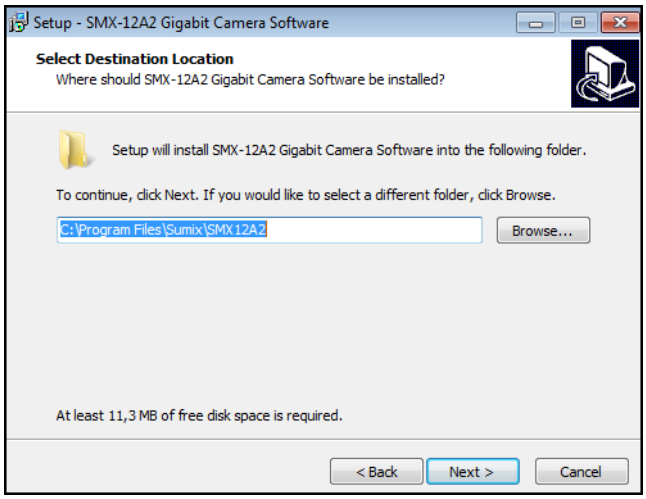


Figure 2-5 *Select Destination location box*

7 In the same way, in the **Select Start Menu Folder** box, leave the suggested location or specify the folder you wish. Click **Next**.

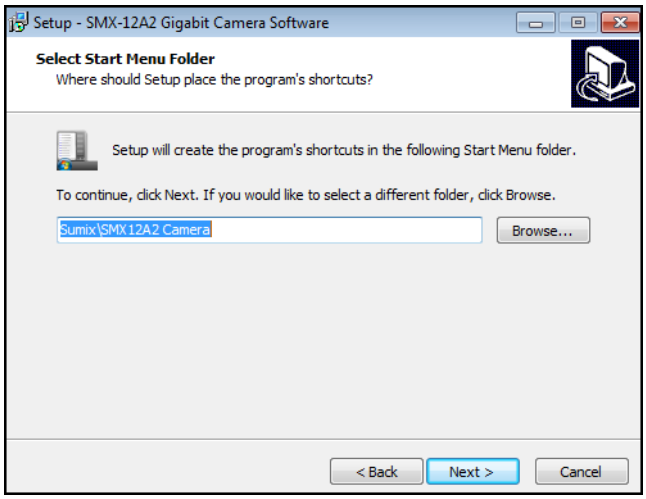


Figure 2-6 *Select Start Menu Folder box*

8 In the **Ready to Install** step, view the options you selected and click **Install**.

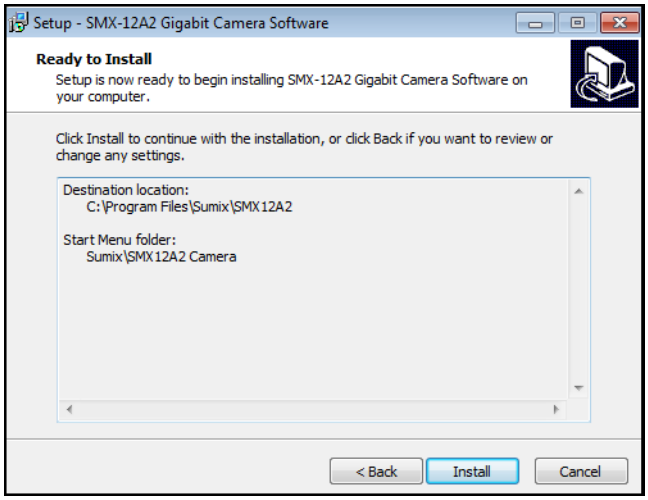


Figure 2-7 *Ready to Install box*

9 The wizard will start to install the application on your computer.

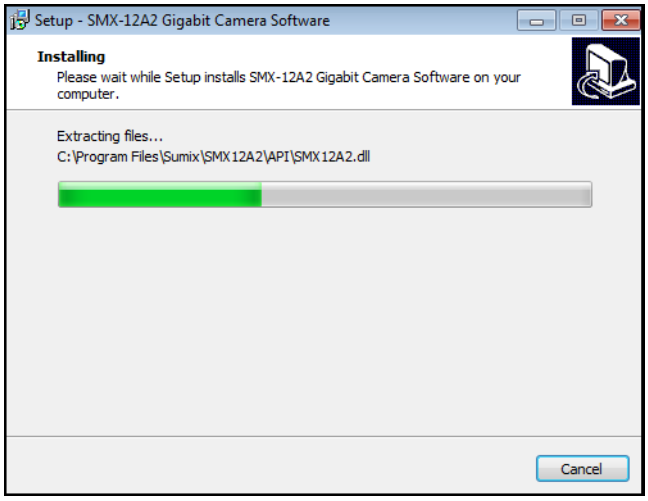


Figure 2-8 *Installing box*

10 In the **Completing Wizard** box, select additional icon that you wish to create and choose whether you want to launch the application right after the installation, or not. Press **Finish** to exit the wizard.

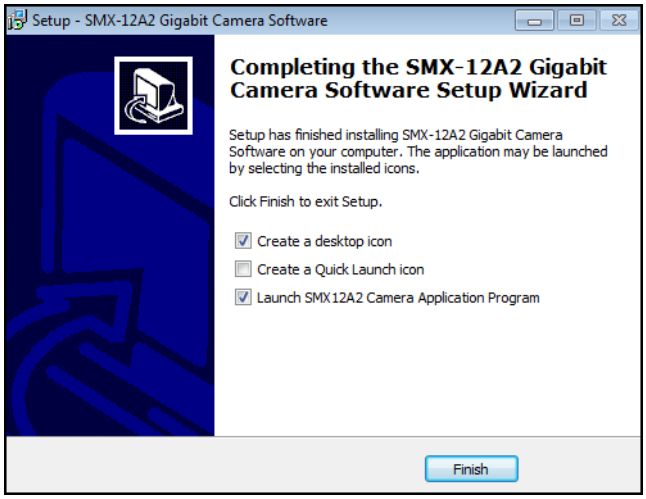


Figure 2-9 *Completing Wizard box*

Step 2: Installing Camera Driver

To install the Camera Driver:

1 Open **Network Connections**.

2 In the **Network Connections** window, right-click **Local Area Connection** and select **Properties**.

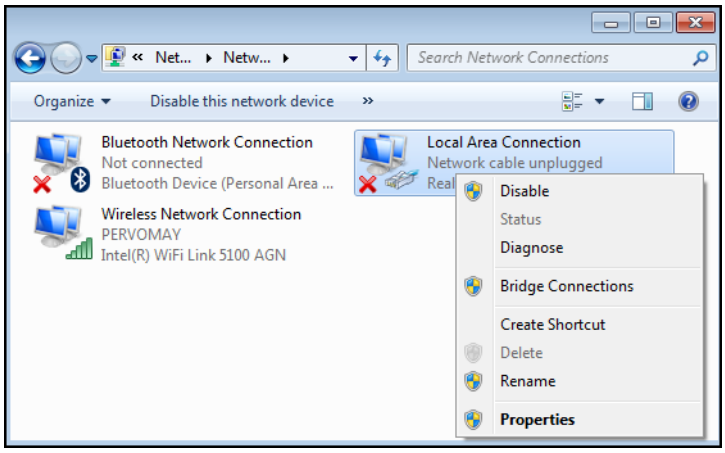


Figure 2-10 *Opening Properties of the Local Area Connection*

3 In the **Local Area Connection Properties** dialog box, deselect all checked items that use this connection. Then press **Install**.

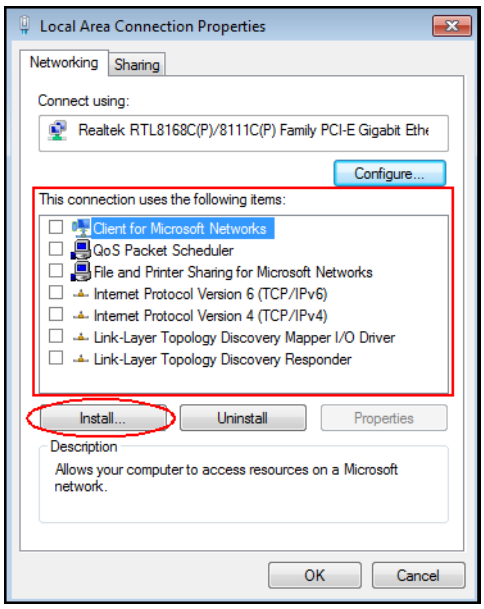


Figure 2-11 *Items that use Local Area Connection*

4 In the **Select Network Feature Type** dialog box, select the **Protocol** item and click **Add**.

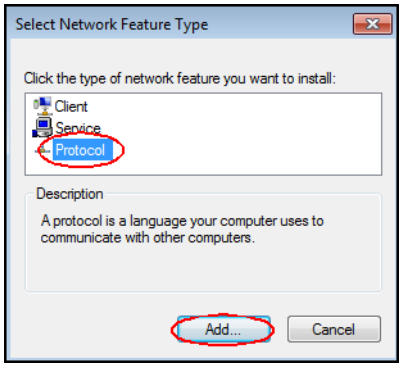


Figure 2-12 *Adding the Network Component: Protocol*

5 In the dialog box that will appear, press the **Have Disk** button.

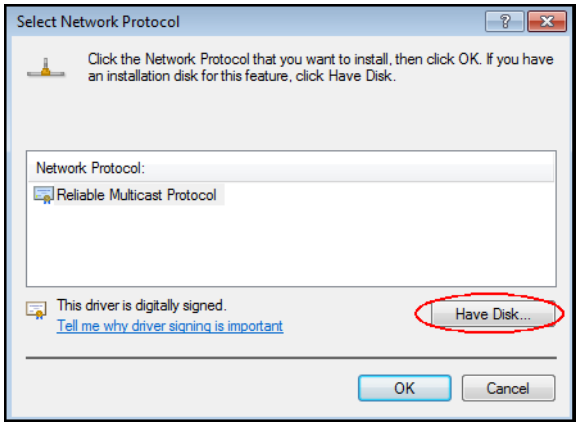
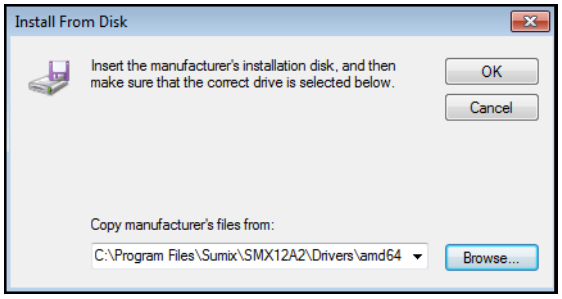


Figure 2-13 *Select Network Protocol dialog box*

6 Browse to the **SMX12A2.inf** file that is located in the SMX-12A2 Camera Software installation folder (the default location is **C:\Program Files\Sumix\SMX12A2**) and click **OK**.



7 In the **Select Network Protocol** dialog box, select the **SMX12A2 Gigabits camera protocol Driver** and click **OK**.

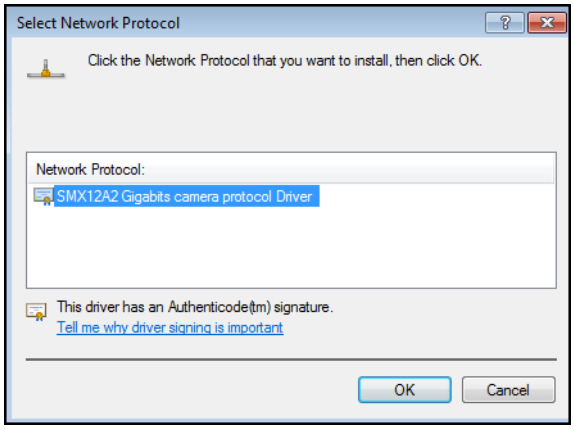


Figure 2-14 *The SMX12A2 Gigabits camera protocol Driver*

8 In the **Windows Security** box, press **Install**.

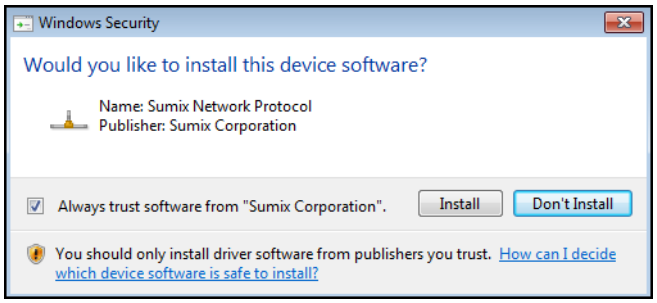


Figure 2-15 *Windows Security box*

The **SMX12A2 Gigabits camera protocol Driver** will appear among the **Local Area Connection** items. Make sure that only the **SMX12A2 Gigabits camera protocol Driver** is selected and checked, then close the **Local Area Connection** dialog box.

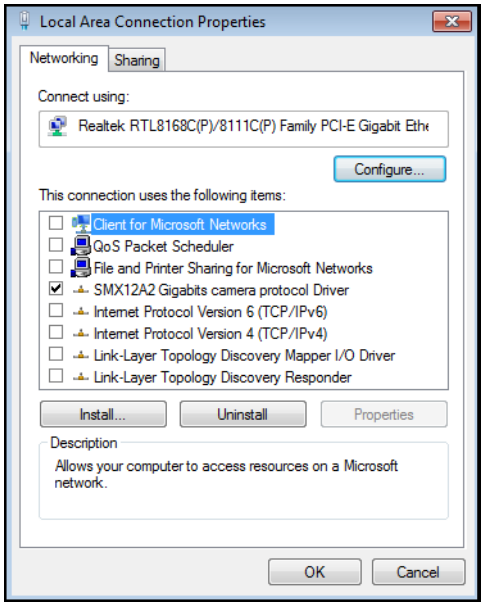


Figure 2-16 *Camera driver installed*

The camera is installed and ready to be used.

Chapter 3

GETTING STARTED

Installing Lens

To use a lens with the camera, remove the cover from the camera and install a lens as described below. Face the camera down to prevent the sensor contamination.

To install a lens:

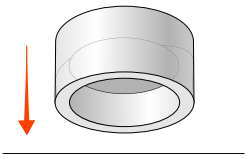
1. Face the camera down.
2. Remove the camera cover.
3. Screw the lens in.

To remove the lens

1. Face the camera down.
2. Screw the lens out.
3. Put on the cover.

Note: *Before screwing the lens in or putting on the cover, make sure that the surfaces are free from dust.*

When you remove the cover, put it facing down to keep dust out.



Connecting the Camera

For connecting the SMX-12A2x Camera to the computer, use the Power Over Ethernet (PoE) IEEE 802.3af power supply and two RJ 45 standard Ethernet cables. It has two Ethernet ports: **IN** and **OUT**.

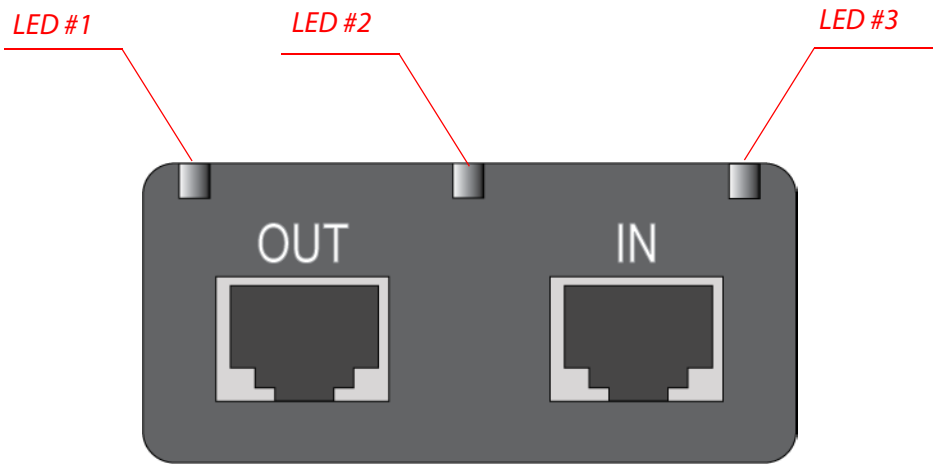


Figure 3-1 *IN and OUT Ethernet ports of PoE power supply*

To connect the camera:

1. Connect one Ethernet cable to the computer and to the **IN** port of the power supply.
2. Connect another Ethernet cable to the SMX-12A2x camera and to the **OUT** port of the power supply.
3. Connect the power supply to the AC outlet.

When the cables are connected to the power supply correctly, the **LED #1** and **LED #3** will light up green. If the connection is not correct, the **LED #2** will flash red.

When all connections are done, LEDs of the Ethernet port of the camera will light up.

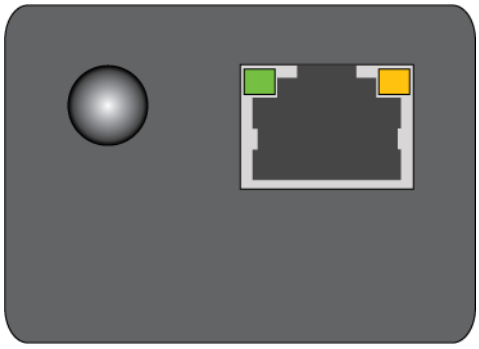


Figure 3-2 *Ethernet port of the camera*

The left LED of the camera Ethernet port represents the video stream from the camera. When video is running, the LED lights up green. When video is stopped, the LED switches off.

The right LED of the camera Ethernet port represents the camera connection and data transferring status. When the camera is connected correctly and connection is Gigabit, the LED lights up yellow. Otherwise it is switched off.

Restarting the Camera Driver

Before launching the **Camera Application,** the camera driver should be restarted.

To restart the camera driver:

Go to **Start> Programs> Sumix> SMX12A2 Camera> DRV** and run the **Restart SMX12A2 Camera driver** command.

Note *Camera driver should be **restarted** each time after connecting the camera or when the camera work was interrupted. In Windows 7, run the **Restart** command as administrator.*

*It is strongly recommended to **stop** the camera driver each time before the camera is disconnecter.In Windows 7, run the **Stop** command as administrator.*

Starting the Application

After the camera is connected and the driver is restarted, you can open the camera application. Go to **Start> Programs> Sumix> SMX12A2 Camera> SMX12A2 Camera Application Program**.

The application will start with its main window.

Note: *In Windows 7, you need to run the camera application as administrator.*

The SMX-12A2x camera application consists of the following parts:

- Main window which contains the main functions. On the top of the main window, there is an application toolbar:

Figure 3-3 *The SMX-12A2x camera application main window*

When the video is started, it is shown in the main window. Start the video stream using the **Start** button:

- **Histogram** which reflects all color settings of the camera.

To open the histogram:

Press the **h** button on the keyboard or select **Histogram** from the **Device** menu. Camera hardware diagram will appear showing signal for different colors.

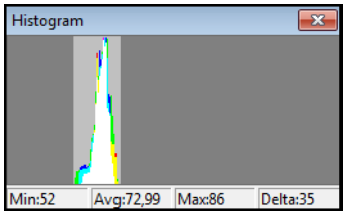


Figure 3-4 *Camera hardware histogram*

Click in the window, and the software histogram will appear instead.

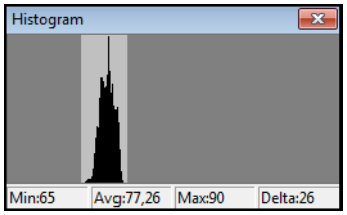


Figure 3-5 *Camera histogram*

You can also open the raw histogram by pressing **Ctrl+h** or via the **Device** > **Histogram RAW** menu.

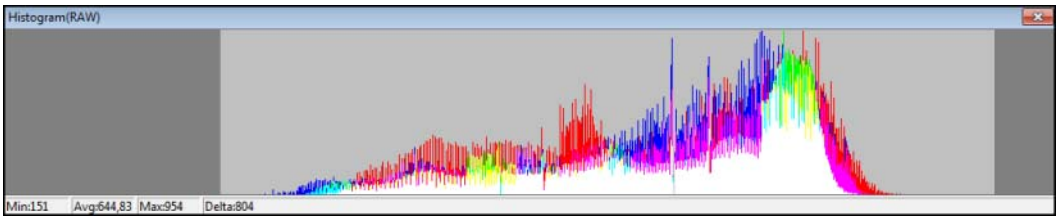


Figure 3-6 *Camera Raw histogram*

Note: The histogram window is empty when the video is not started.

- **Settings** window contains camera settings.

To open the Settings window:

Select **Settings** from the **Device** menu or press **Alt+s** on the keyboard.

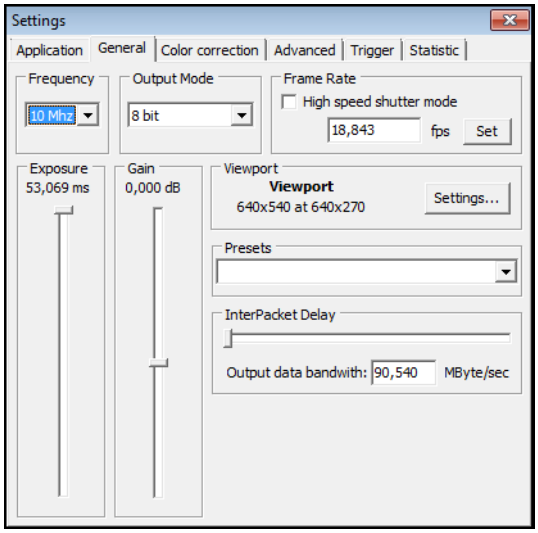


Figure 3-7 *Settings window*

Chapter 4
TUNING GUIDELINES

Initial Settings

Start video from the camera using the **Start Video** button on the camera application's toolbar:

The illumination of the camera's image depends on the values of frequency, exposure, gain and the image dimensions (resolution).

The recommended initial settings are:

- **Gain** is set to 0 and **Exposure** slider is in the highest position
- **Output Mode** is set to 8 bit or 8 bits compress if you will view video on display
- **Viewport** size is maximum (**Settings** box > **General** tab > **Viewport** section)
- For color camera, **Color Mode** is set to **Bilinear** (**Settings** box > **Advanced** tab > **Debayer algorithm** section)
- **Frequency** is set to the required value depending on the frame rate you want to achieve: the higher the frequency, the greater the frame rate is.
- **Histogram** is active (**Main menu >Device > Histogram** is selected or **h** is pressed)

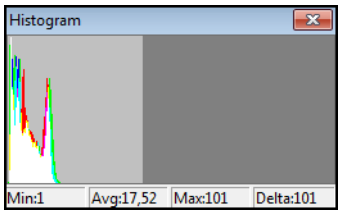


Figure 4-1 *Histogram of initial state*

- For color camera, the **Brightness**, **Contrast**, **Gamma** sliders of the **Color Correction** tab are in the central position (their values are 1, 1, 1, respectively). To reset the values for all sliders at one go, click the **Default** button. To reset one of them, double-click its value at the right end of the slider bar

Tuning Light in the Image

To tune illumination, install a lens first (see "Installing Lens" on page 17).

To tune light in the image:

1. Use maximum diaphragm aperture of your lens.
2. If the **Exposure** slider is at maximum and more light is needed, decrease frequency (it will enlarge the exposure interval).
3. If illumination is not enough, increase gain using the **Gain** slider.

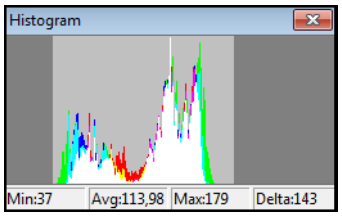


Figure 4-2 *Histogram after illumination is tuned*

Color Tuning

For the SMX-12AC color camera model, you can achieve the best colors of the image.

To tune colors of the image:

1. Go to the **Color Correction** tab and try to make the histogram as wide as possible using the **Brightness**, **Contrast** and **Gamma** sliders. For more information on color correction, see "Color Correction Settings" on page 27.
2. After color correction is done, perform **White Balance**. Press the **White Balance** button.

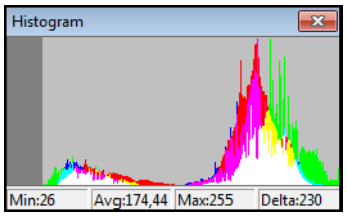


Figure 4-3 *Histogram after White Balance is performed*

3. You can also improve colors using the **Color enhancement** slider at the **Advanced** tab. To adjust colors, move the slider to the right.

Sensor Settings

Sensor settings are located in the **General** tab of the **Settings** window. They are as follows.

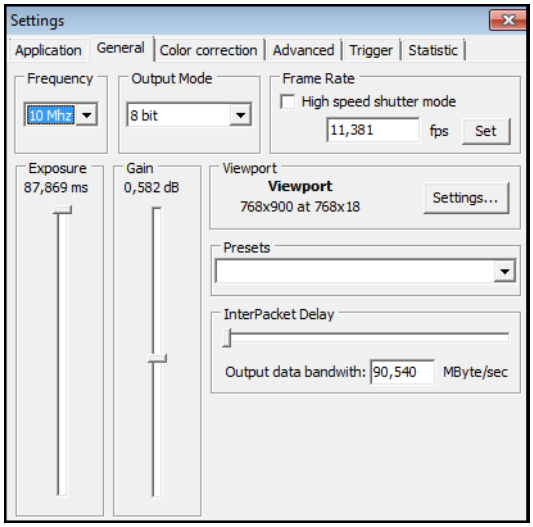


Figure 4-4 *Sensor settings*

Frequency

This control defines the pixel clock **Frequency** of the sensor. The lower the **Frequency**, the higher maximum possible **Exposure** time and the less frame rate. This control defines the **Frequency** of polling the camera for its image stream.

Exposure

The camera **Exposure** parameter defines time for which the sensor is consuming light energy. Use the **Exposure** slider to adjust the camera exposure time. The current exposure time in milliseconds is displayed below the control. This value depends on viewport height and sensor frequency.

Gain

Use the **Gain** control to change the signal gain of the sensor. Increasing the gain is reasonable when the light condition is poor and increasing the exposure does not help.

Viewport

The **Viewport** is a rectangular area of the sensor on which the image is scanned. It can have variable size, from full field of view of the sensor to the small area. The smaller vertical size (in lines) of the viewport, the faster scan process and the higher frame rate.

To change the viewport:

1 Press the **Settings** button in the **Viewport** section on the **General** tab.

2 The **Viewport** window will open.

Figure 4-5 *Changing viewport*

3 You can select one of the predefined viewport options. If the viewport size is smaller than maximum viewport size, drag the rectangle across the full viewport resolution area for the viewport window. You will notice how the image in the **View Mode** window changes with the movement.

4 Alternatively, you can change values in the following fields:

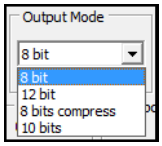
- **Offset X, Y** fields with coordinates of the top left corner of the rectangle
- **Size X, Y** fields with coordinates of the bottom right corner of the rectangle

you can also change it by dragging the video image in the **Video mode** window.

5 Press **Apply** to save changes.

Output Mode

The camera can transmit raw video data in one of four output modes. Use the drop-down box of the **Output Mode** section to switch between camera modes.



- **8 bit** - select this option for viewing video on display
- **8 bit compress** - this mode provides the highest frame rate

Note: *Before processing 8 bit compressed camera output, make sure that it is decompressed.*

- **10 bit**, **12 bit** - you can enable these modes for demonstration purposes, e.g. you can view camera statistics via the **Statistics** tab in the **Settings** box.

Frame Rate

You can manage frame rate when the video is running. Type in the required value in the field in the **Frame Rate** section and press **Set**. You will not be able to set frame rate higher or lower than some limits for current viewport size and frequency.

When the **High speed shutter mode** is checked, the application shows each second frame of the video stream. It will be useful when camera is running with high frequencies.

Note: The High speed shutter mode is available only for frequency of 50MHz and higher.

The High speed shutter mode does not work for the 8 bit compress mode.

Color Correction Settings

These controls are available for the SMX-12A2C color model. The **Color correction** settings are conversions used to correct colors and intensity of the image displayed by the application in 8 bit or 10 bit modes. These are four Lookup Tables (LUTs) that provide output data for mono (all color components) as well as red, green and blue color components.

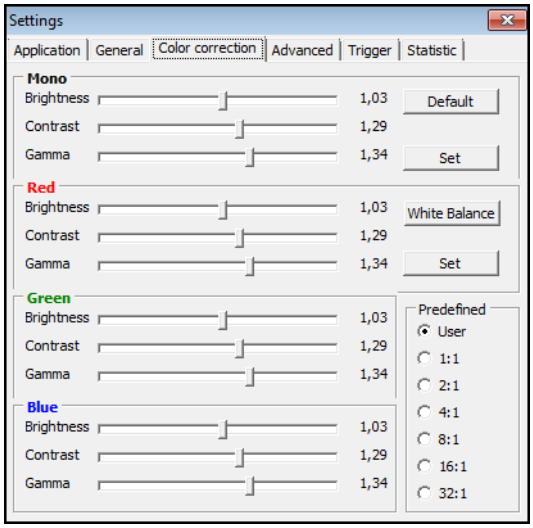


Figure 4-6 *The Color correction settings*

Mono

Use the sliders of the **Mono** conversions to change **Brightness/Contrast/Gamma** for all **R**, **G** and **B** color components simultaneously. After you move a slider, press the **Set** button below the **Default** button to apply the changes.

Red

Use the sliders of the **Red** conversions to change **Brightness/Contrast/Gamma** for the red component only. After you move a slider, press the **Set** button below the **White Balance** button to apply the changes.

Green

Use the sliders of the **Green** conversions to change **Brightness/Contrast/Gamma** for the green component only. After you move a slider, press the **Set** button below the **White Balance** button to apply the changes.

Blue

Use the sliders of the **blue** conversions to change **Brightness/Contrast/Gamma** for the blue component only. After you move a slider, press the **Set** button below the **White Balance** button to apply the changes.

Important: *After color correction, you need also to perform white balance using the **White Balance** button.*

To restore defaults of **Brightness**, **Contrast** and **Gamma**, click the **Default** button.

Note: *White Balance changes are not reflected at the Color correction settings window. It influences only the video from the camera.*

Note: *Red, Green and Blue conversions are disabled for the SMX-12A2M (monochrome) camera.*

Predefined

The **Predefined** options allow loading predefined settings of the **Mono** conversions. They can be useful for checking quality of the sensor. Select one of the buttons to load a desired **Predefined** conversion.

Note: *The Predefined settings are not reflected in the Color correction Settings window. It influences only the video from the camera.*

Advanced Settings

Some settings for advanced users are located at the **General** tab of the **Settings** dialog box: **Presets** and **InterPacket Delay**. The rest are at the **Advanced** tab.

Presets

Presets are predefined conversions of 12 bit signal to 8 or 10 bits done by programming of sensor's registers. They are available for four operating modes.

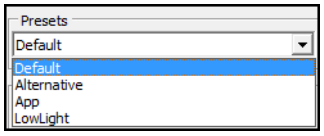


Figure 4-7 *Presets drop-down box*

- **Default** - provide a relatively good output in usual light conditions
- **Alternative** - settings for HDTV with 30 fps
- **App** - settings from an older application version
- **LowLight** - provide a relatively good output in low light conditions.

InterPacket Delay

The **InterPacket Delay** allows you to set a delay for sending every second frame. This control is useful when you run the camera via a non-Intel network adapter with which the best video quality is not guaranteed.

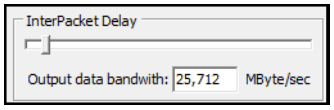


Figure 4-8 *InterPacket Delay*

If you tried all means to improve the image but it still contains broken pixels or horizontal distortions, move the slider a bit and see if the video from the camera improves. The field below the slider will show how gigabit ethernet bandwidth value changes with moving the slider.

Debayer algorithm

There are several color transmission algorithms available by which the Bayer matrix from the sensor is transformed into a destination stream:

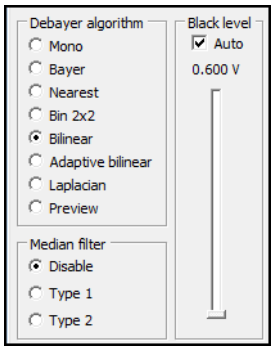


Figure 4-9 *Advanced settings*

- **Mono** - sensor pixels data is transformed into a monochrome stream
- **Bayer** - standard Bayer matrix
- **Nearest** - this is the fastest algorithm that gives the worst, compared to other algorithms, image quality
- **Bin 2x2** - four adjacent Bayer matrix pixels become one RGB pixel
- **Bilinear -** this a slower algorithm that gives a better quality, the optimal option in terms of quality and noise sensitivity
- **Adaptive bilinear** - improved bilinear algorithm
- **Laplacian** - the slowest algorithm that gives the best quality and high noise sensitivity
- **Preview** - 1:2 decimation (every second pixel is excluded from the image) that gives a relatively good video output on slow computes.

Black level

Black level slider allows changing sensor's level of black. By default, this value is set automatically. But when additional tuning is needed, you can uncheck the **Auto** box and move the slider up or down to improve the image. However, in most of the cases, it is recommended to change brightness instead (see "Color Correction Settings" on page 27).

Median filter

Median filter turns on pixel averaging. The brightness of every single pixel becomes affected by the brightness of its neighbor pixels and the whole image becomes smoother.

There are two types of the hardware median filter:

- **Median Filter Type 0 -** reduces speckle noise and salt and pepper noise.
- **Median Filter Type 1 -** preserves edges and is useful when edge blurring is undesirable.

Hardware gamma correction

Check the **Enable gamma correction** box if you want the camera to perform gamma correction on the hardware level.

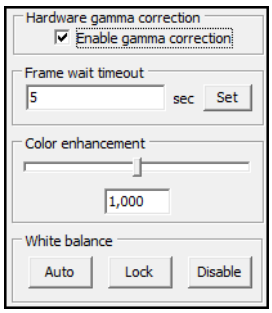


Figure 4-10 *Advanced settings*

However, in most of the cases, it is recommended to use the **Gamma** sliders in the **Color correction** tab (see "Color Correction Settings" on page 27).

Frame wait timeout

Frame wait timeout allows you to set a time interval in seconds during which the application will wait for an external triggering pulse. It is needed for grabbing frames triggered by an external hardware. There are also other settings related to trigger that can be edited via the application interface (see "Trigger Settings" on page 32). For instruction how to use Hirose trigger with the camera, see "External Trigger" on page 45.

Color Enhancement

Use this slider to improve colors by means of hardware without loss in frame rate. By default, the slider is in the central position. Moving it to the right results in color enhancement. With leftmost slider position, the image becomes monochrome.

White Balance

This control is available for the SMX-12A2C color model. By default, white balance is set automatically for each frame on the hardware level. If you are not satisfied with the result, you can adjust it using a white sheet of paper and then apply it for all subsequent frames.

To adjust white balance:

1. Put a white sheet of paper or a white object in front of the camera and focus the lens.
2. Make sure auto white balance is enabled (press **Auto**).
3. Press **Lock**.

Press the **Disable** button if you do not want to balance white, e.g. when you perform color calibration.

Software Image Correction

Software image correction section allows adjusting **Hue**, **Lightness** and **Saturation** of the image on the software level. By default, these controls are disabled. To enable the **Hue**, **Lightness** and **Saturation** sliders, select **HSL** from the drop-down list.

Figure 4-11 *Enabling Hue, Lightness and Saturation sliders*

The **Matrix** option from the drop-down box allows adjusting colors of the video stream using a calibration file (see "Color Calibration" on page 35).

Trigger Settings

You can initiate video capturing by applying a triggering pulse to the camera. The **External input** controls at the **Trigger** tab allow you to monitor input signals sent to the camera via the trigger connector. For more information about connector pinouts and for instructions on how to prepare the connector for use with the camera, see "External Trigger" on page 45.

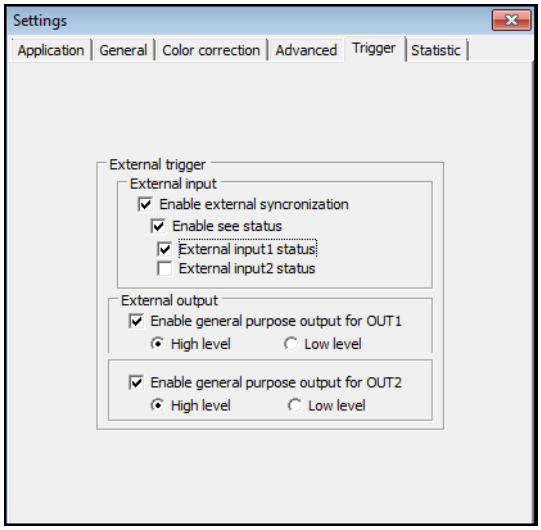


Figure 4-12 *Trigger Settings*

- **Enable external synchronization** - after an external equipment has been connected to the camera and a triggering pulse has been applied, check this box to stop the video stream and to start capturing a frame
- **Enable see status** - check this box if you want to see if a triggering pulse has been applied to the camera via connector input 1 or input 2:
  - **External input1 status** - the box checked means that an external pulse has been applied to the camera via input 1
  - **External input2 status** - the box checked means that an external pulse has been applied to the camera via input 2

Set also frame wait timeout at the Advanced tab (see "Frame wait timeout" on page 31).

The **External output** controls will be useful if you program the camera to send signals of high or low level to other software or equipment. External outputs 1 and 2 in this mode will operate as general purpose outputs (GPO).

Statistic Settings

The **Statistic** tab of the **Settings** box shows information about data transmission from the camera. If you suspect camera malfunction, check the statistics and/or send a screenshot to Sumix support (male to *camera@sumix.com*).

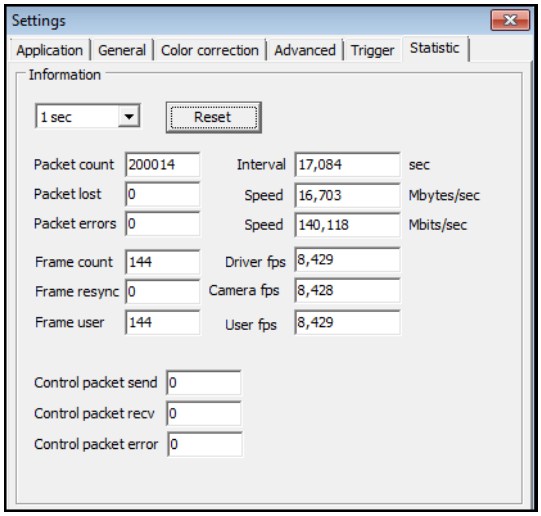


Figure 4-13 *Statistic Settings*

From the drop-down box, select a statistics update interval. If you want to reset the data shown in the fields, press **Reset**.

Chapter 5

Color Calibration

The SMX-12A2x camera software allows you to calibrate colors using a color rendition chart. You can create calibration files for different light conditions and then apply them depending on camera location.

Calibration Procedure

Before calibration, prepare the following:

1. Install an IR-cut filter and lens on the camera.
2. Put a color rendition chart in front of the camera.

Note: Without an IR-cut filter, color calibration will not perform correctly.

To calibrate colors:

1. Start video from the camera.
2. Disable auto white balance, otherwise calibration will not perform correctly:
   a. Press **Alt+s** to open the **Settings** dialog box.
   b. Click the **Advanced** tab.
   c. Go to the **White Balance** section and press **Disable**.
3. Set the maximum viewport size (**Settings** > **General** > **Viewport**).
4. Adjust focus and image like it is shown below. Decrease zoom so that the image fits the application window:

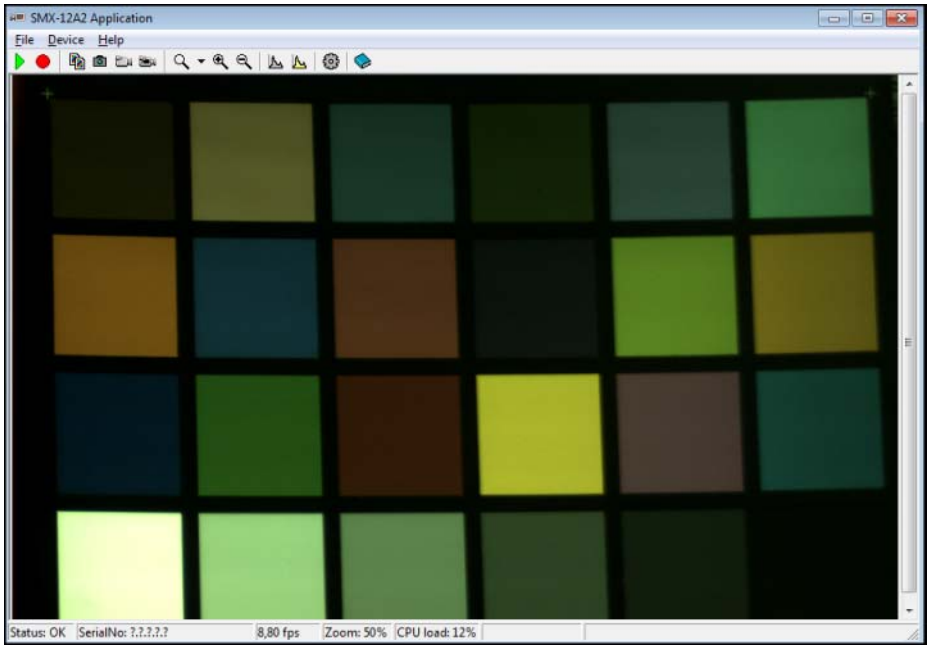


Figure 5-1 *Camera shooting the rendition chart*

5 Go to the **Advanced** tab of the **Settings** window and press **Calibrate** in the bottom right corner of the window. The drop-down box below the **Calibrate** button should be set to **None**.

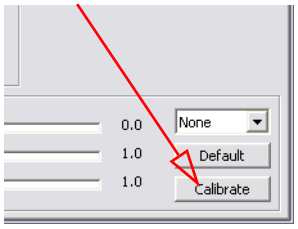


Figure 5-2 *The Calibrate button of the Advanced Settings*

6 The **Color Calibration** window will open.

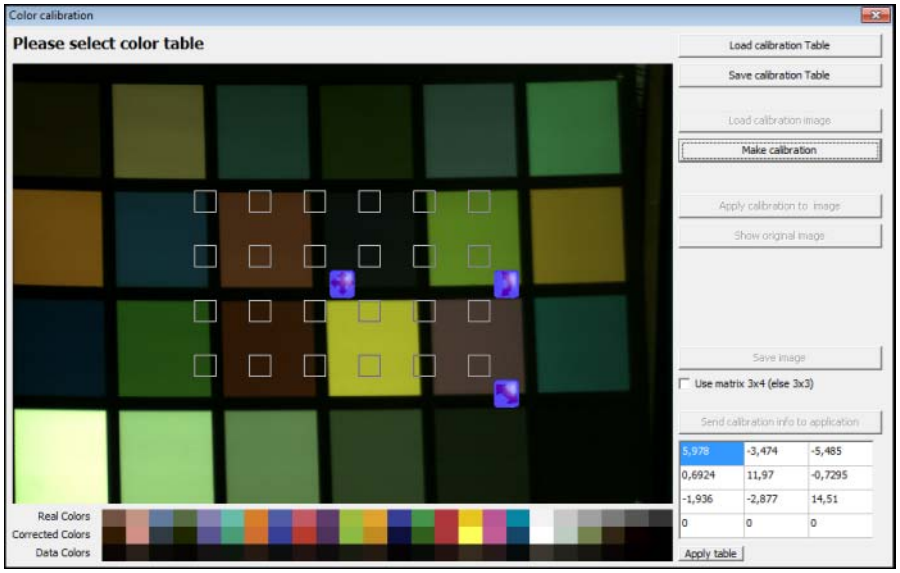


Figure 5-3 *Color Calibration window*

7 Resize the grid so that each square is placed within each color square of the chart. Use the controls with arrows.

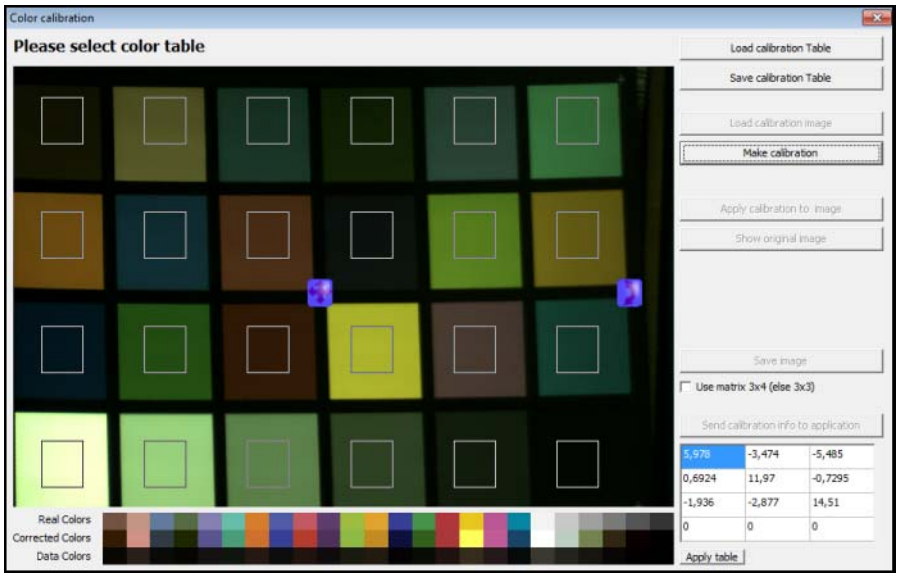


Figure 5-4 *Color Calibration: resizing the grid*

8 Press the **Make calibration** button.

9 After the calibration is finished, press the **Send calibration info to application** button.

Using Calibration Results

When calibation is done, its results can be used for color correction of the video from the camera.

To use the calibration results:

1 Open the **Settings** window, the **Advanced** tab.

2 Choose **Matrix** from the drop-down box in the **Software image correction** section.

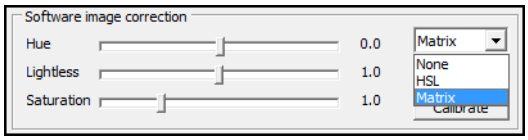


Figure 5-5 *The Camera Color Calibration use*

3 The calibration results will be applied to the current image from the camera.

Note: *If light conditions change, you need to calibrate colors again.*

Chapter 6
CAPTURING

Capturing Single Frames

To capture and save a single frame:

1 Tune video from the camera (see "Tuning Guidelines" on page 29).

2 Click the **File** menu and select the **Save Frame** command or press **F2**. You can also click in the toolbar.

Frame will be saved as a **.BMP** file in the directory defined in **Settings** (see "Saving Options" on page 42).

To copy a frame to buffer:

Click the **File** menu and select the **Copy Frame** command or press **Ctrl+c**. You can also click in the toolbar.

Note: *The SMX-12A2x application saves frame as .BMP file with color depth of 8 bits only.*

Saving Video Files

To save video in *.AVI files:

1 Tune video from the camera (see "Tuning Guidelines" on page 29).

2 Click the **File** menu and select the **Save AVI VIdeo** command or press **F3**. You can also click in the toolbar.

Video will be saved as an **.AVI** file in the directory defined in **Settings** (see "Saving Options" on page 42).

To save raw video:

1 Tune video from the camera (see "Tuning Guidelines" on page 29).

2 Click the **File** menu and select the **Save AVI VIdeo** command or press **F3**. You can also click in the toolbar.

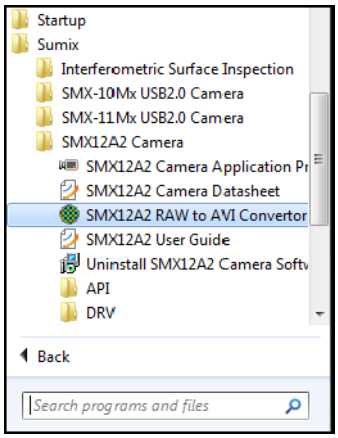
Video will be saved as a **.RAW** file in the directory defined in **Settings** (see "Saving Options" on page 42).

SMX12A2 Viewer and Converter

The SMX-12A2x Viewer and Converter application allows viewing and adjusting of raw video files, mainly 10 bit or 12 bit, and then converting them to 8 bit **.AVI** format.

To open the converter application:

Go to **Start> All Programs> Sumix> SMX12A2 Camera** and select **SMX12A2 RAW to AVI Convertor**.



Convertor interface and its controls are similar to those of the camera application.

To open a raw video file recorded in the SMX-12A2x camera application:

1 Go to the **File** menu and select **Open RAW file**.

2 The first video frame will open in the convertor window.

You can adjust and correct video or video frame in the convertor in the same way and using the same controls as in the camera application.

To adjust raw video/video frame:

1 Press the **Start video** button in the toolbar if you want to adjust the whole video.

2 Press the **Next frame** button in the toolbar to scroll to frame you want to adjust.

3 Open histogram box to see how it is changed with your adjustment. Press **Alt+h** on the keyboard.

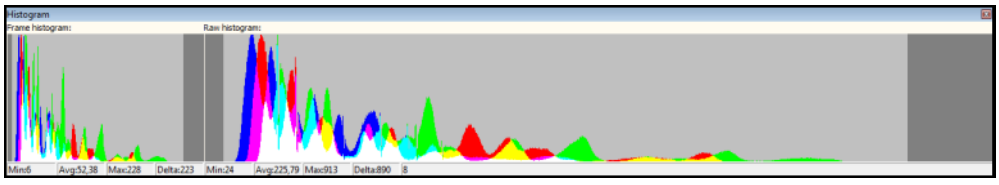


Figure 6-1 *Convertor histogram*

Left part of the histogram is for frame, right part is for video.

4 Click **Alt+s** to open the **Setting** dialog box.

5 Select a Debayer algorithm option you want to apply to the video.

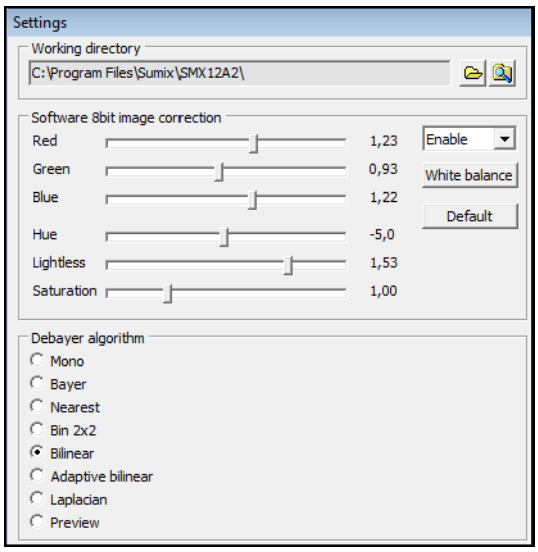


Figure 6-2 *Selecting Debayer algorithm options*

6 Now you can correct colors in 10 or 12 bit videos using the right half of the **Settings** box.

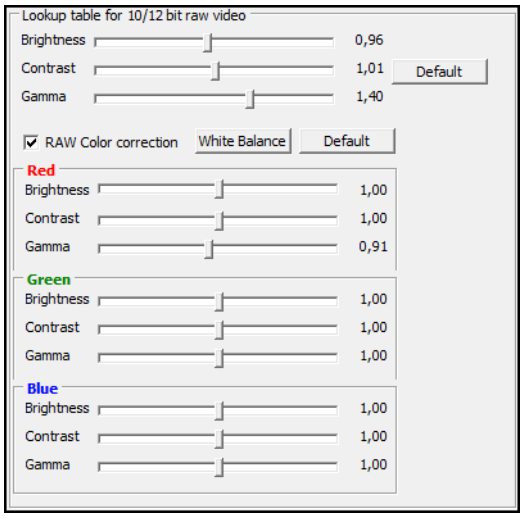


Figure 6-3 *Color correction controls*

Check the **RAW Color correction** box to correct colors for red, green or blue color components. For more information on color correction, see "Color Correction Settings" on page 27.

7 Perform software image correction using the controls in the left part of the **Settings** box. This can be done for 8 bit raw video as well.

After the raw video has been adjusted, you can save it in .AVI format.

To save raw video in .AVI format:

1 Go to the **File** menu and select **Save AVI file** or press **F2**.

2 The video will be saved in the directory defined in settings:

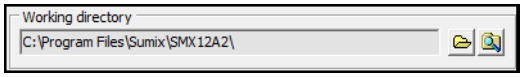
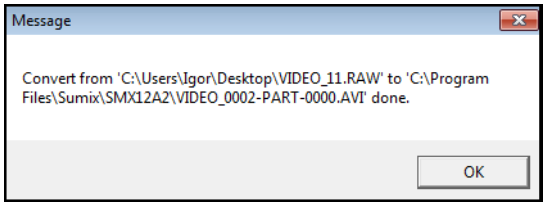


Figure 6-4 *Directory for saving converted files*

3 The notification will appear after conversion.



You can also save raw frames as .BMP file or copy them to buffer.

To save a frame / copy a frame to buffer:

Go to the **File** menu and select **Save Frame** / **Copy Frame**.

Saving Options

To modify saving options:

1 Open the **Settings** box by pressing **Alt+s** and select the **Advanced** tad.

2 Set the following:

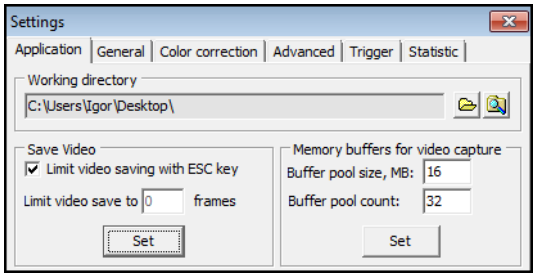


Figure 6-5 *Settings for saving video files*

- **Working directory** - define the folder where videos or frames will be saved, or leave the default one
- **Limit video saving with ESC key** - if this box is checked, press the **ESC** button to stop video stream being saved after launching the **Save video** command
- **Limit video save to** - saved video will contain the number of frames specified in the field
- **Buffer pool size, MB** - size of operative memory buffers that will be reserved for saved video files
- **Buffer pool count** - number of operative memory buffers that will be used for saved video files

Chapter 7

External Trigger

This chapter describes how to use a Hirose trigger connector and cable with the SMX-12A2x camera. Hirose trigger connector is included in the standard camera kit. Since a cable is not included in the standard connector package, this document will guide on how to use the connector with a cable. For more information on trigger settings that can be configured in the camera application, see "Trigger Settings" on page 32.

Connector Pinout

The following table explains layout of trigger pins..

Pin Number	Signal
1	External trigger input or GPI 1
2	Frame start pulse output or GPO 1
3	External power supply (+5V)
4	GeneralPurposeInput 2
5	Inverted frame start pulse or GPO 2
6	Common (Ground)

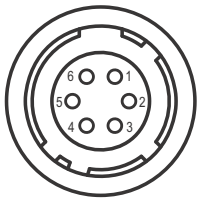


Figure 7-1 *Camera Connector View, as mounted on the camera*

Note: If you connect the camera to an external power supply via the trigger connector instead of PoE adapter, you can achieve better quality of video output.

Powering via External Trigger

Powering the camera via the Hirose trigger is more reliable than via the PoE power supply. It is safer for both the camera and the net card and is more reliable for data transfer.

To power the camera via the external trigger, connect pin 3 of the trigger to a stabilized power source 5 V/1 A. Then connect pin 6 to a ground.

Warning: *Simultaneous use of the Hirose trigger and PoE supply for powering the camera is not recommended.*

Soldering of Connector with Cable

Prepare a standard (6-core) cable with already opened contacts for soldering with the connector.

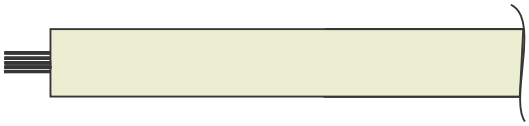


Figure 7-2 *A cable for soldering with the connector*

Prepare a tweezers-like tool for the connector assembling.

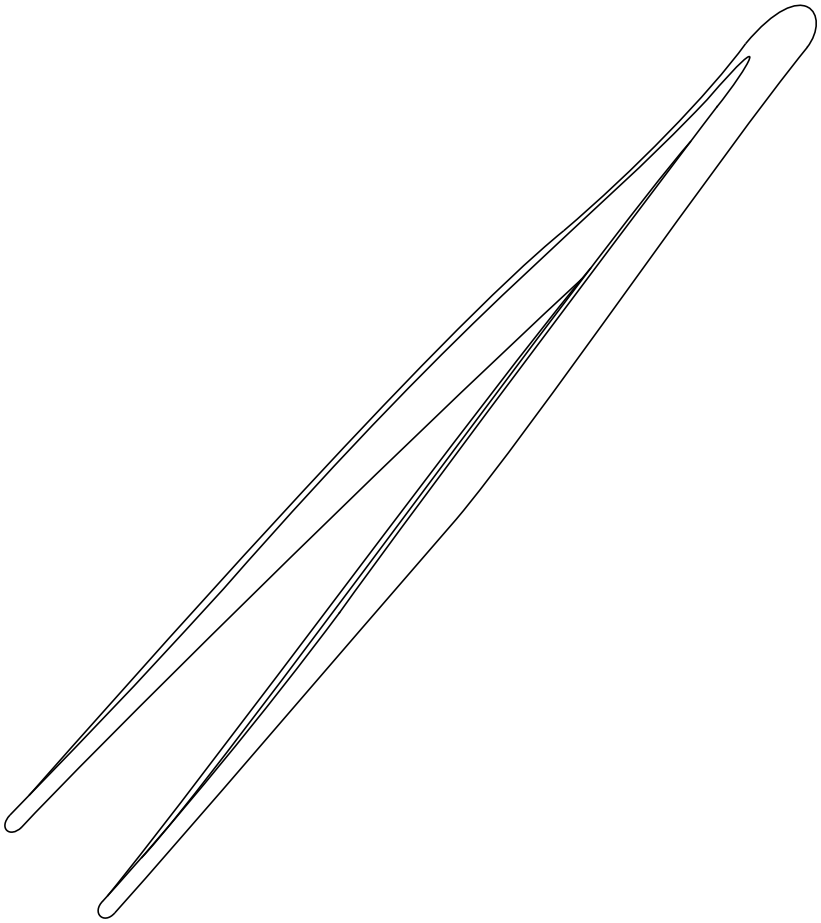


Figure 7-3 *Tweezers tool for the connector modifying*

Unscrew the rear part of the connector.

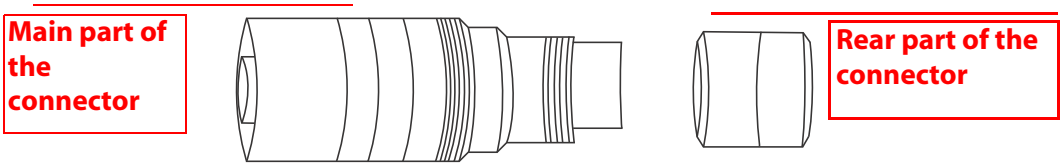


Figure 7-4 *The rear part and the main part of the connector*

Use tweezers and remove it from the main part in the following way:

1 Fix the inner part of the connector with tweezers.

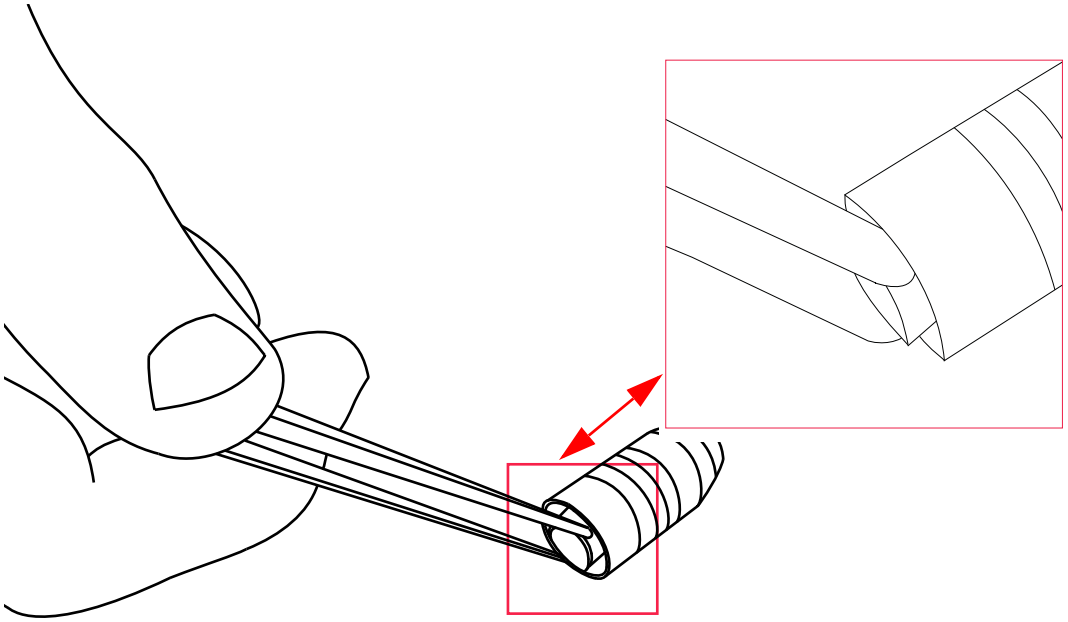


Figure 7-5 *Fixing of the inner part of the connector with tweezers*

2 Unscrew the rear part of the connector with fingers clockwise.

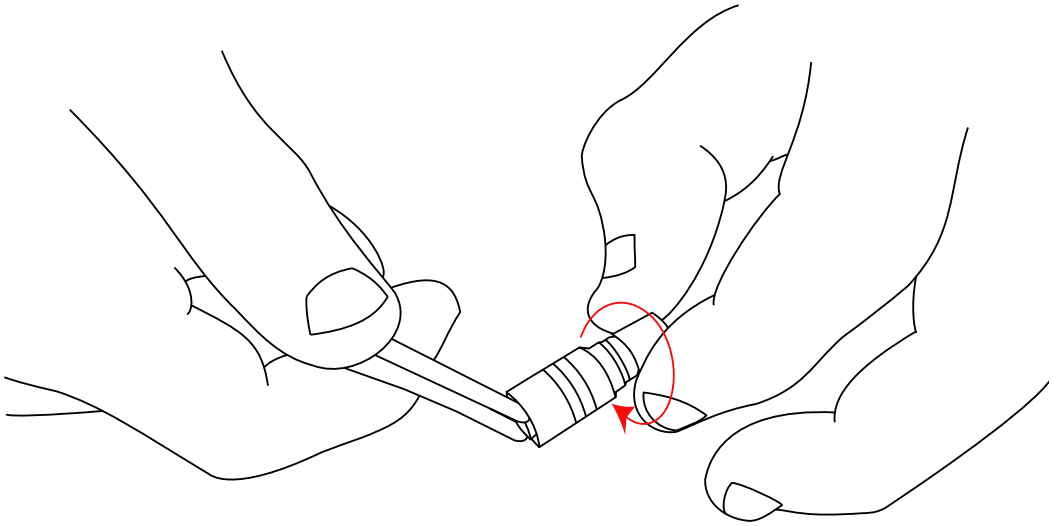


Figure 7-6 *Unscrewing of the rear part of the connector*

3 Remove the rear part of the connector from the main part.

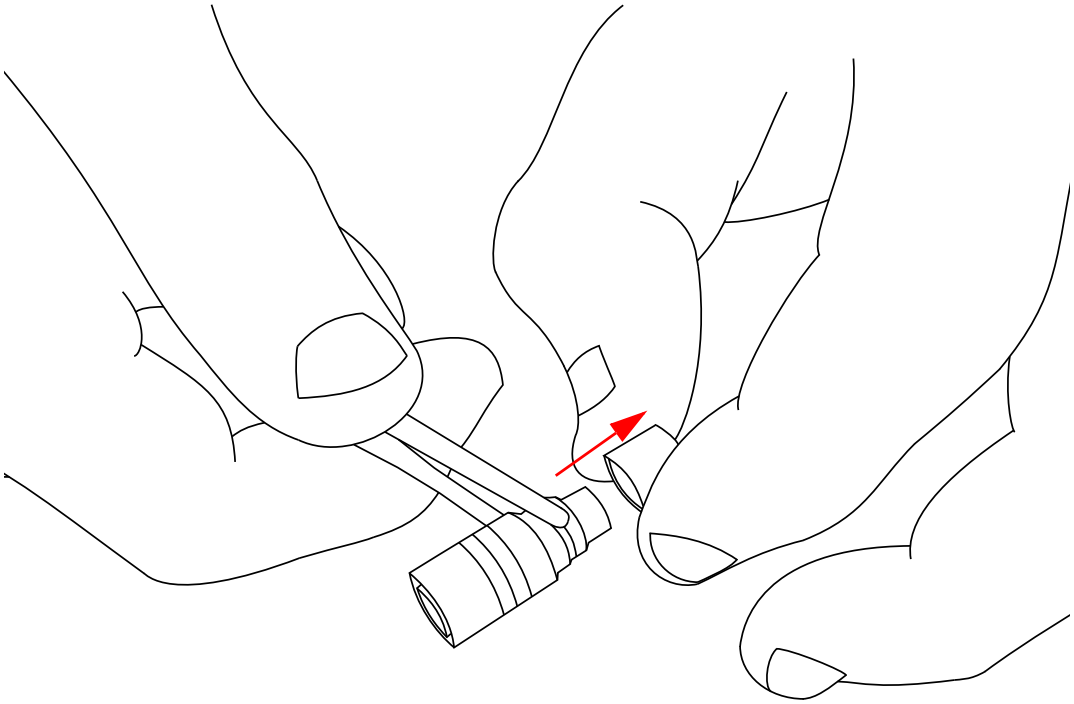


Figure 7-7 *Removing of the rear part of the connector from the main part*

Unscrew the inner part of the connector:

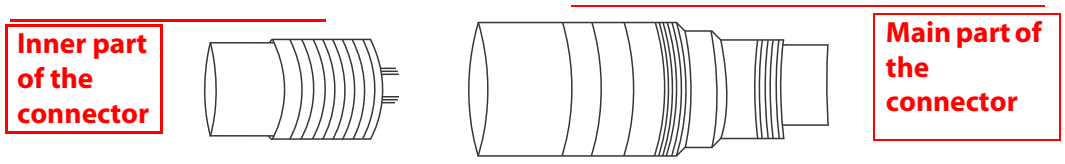


Figure 7-8 *The inner part and the main part of the connector*

To unscrew, perform the following steps:

1 Hold the main part of the connector with your fingers.

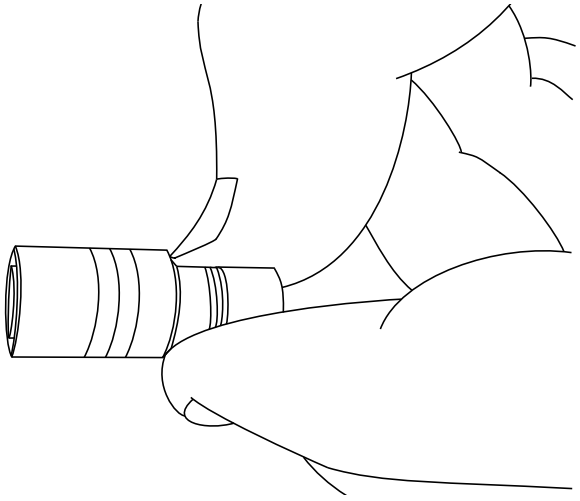


Figure 7-9 *Gripping the main part of the connector with fingers*

2 Fix the inner part of the connector with tweezers (see Figure 7-5 Fixing of the inner part of the connector with tweezers).

3 Rotate tweezers counterclockwise.

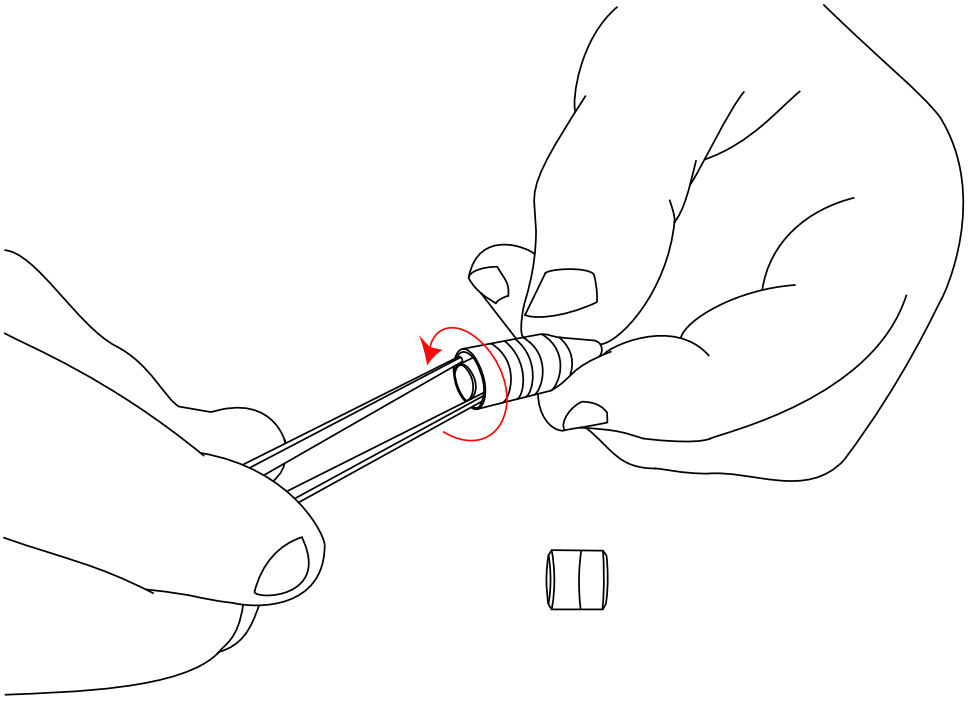


Figure 7-10 *Unscrewing the inner part of the Connector from the main part*

4 Remove the inner part of the connector from the main part.

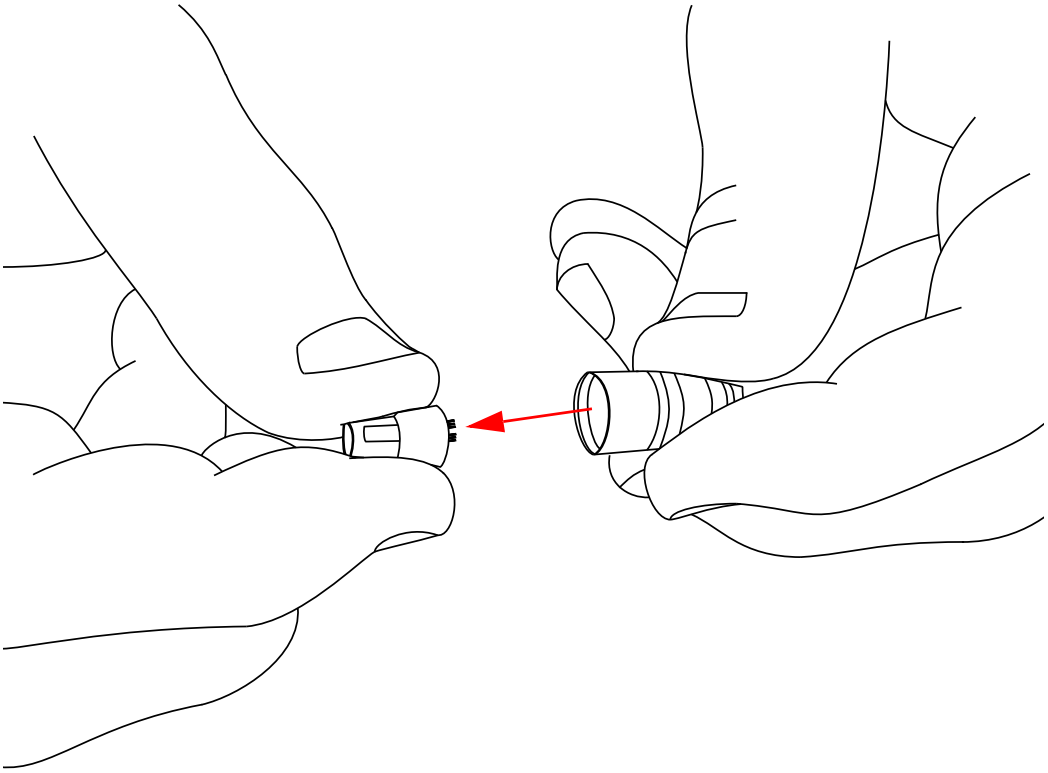


Figure 7-11 *Removing the inner part of the connector from the main part*

As a result, all connector parts will be disassembled:

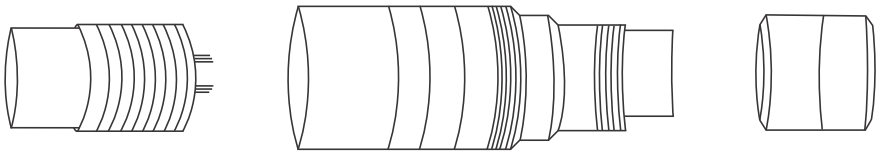


Figure 7-12 *All parts of the connector are disassembled*

Insert a cable into the rear part of the connector.

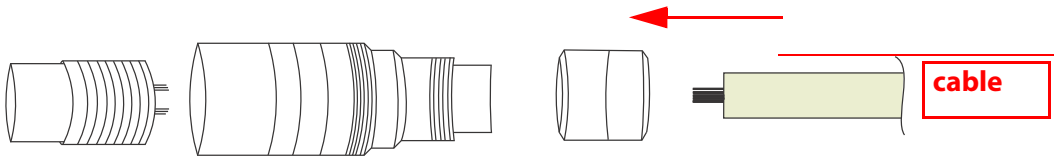


Figure 7-13 *Inserting of a cable in the rear part of the connector*

Then insert it into the main part.

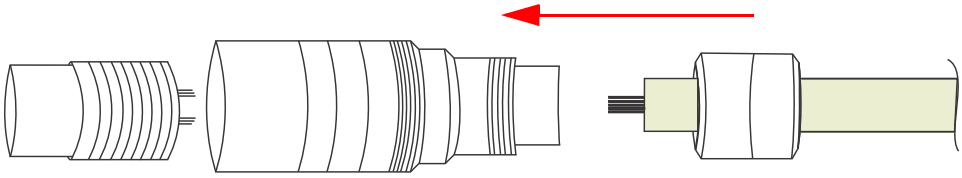


Figure 7-14 *Inserting of a cable in the main part of the connector*

When a cable is inserted into the rear part and the main part correspondingly, solder each pin of the connector with opened contacts of a cable according to the layout (see "Connector Pinout" on page 45) and your specific needs:

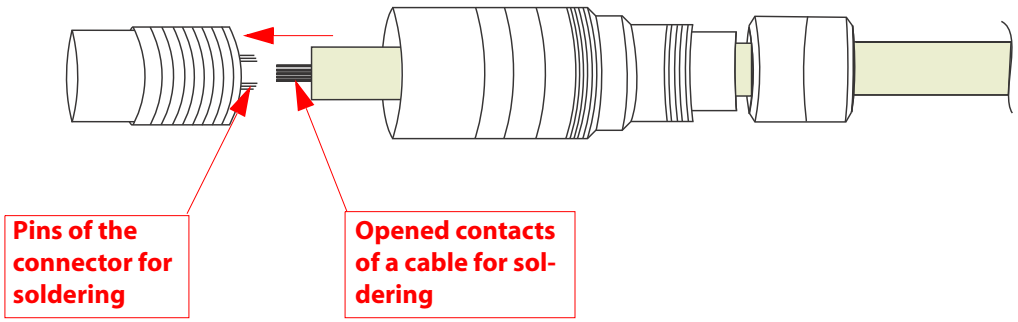


Figure 7-15 *Inserting and soldering of a cable to the inner part of the connector*

Please note that each pin is marked with a number according to the pin layout (see "Connector Pinout" on page 45). The pins numbering is located at the internal side of the inner part of the connector.

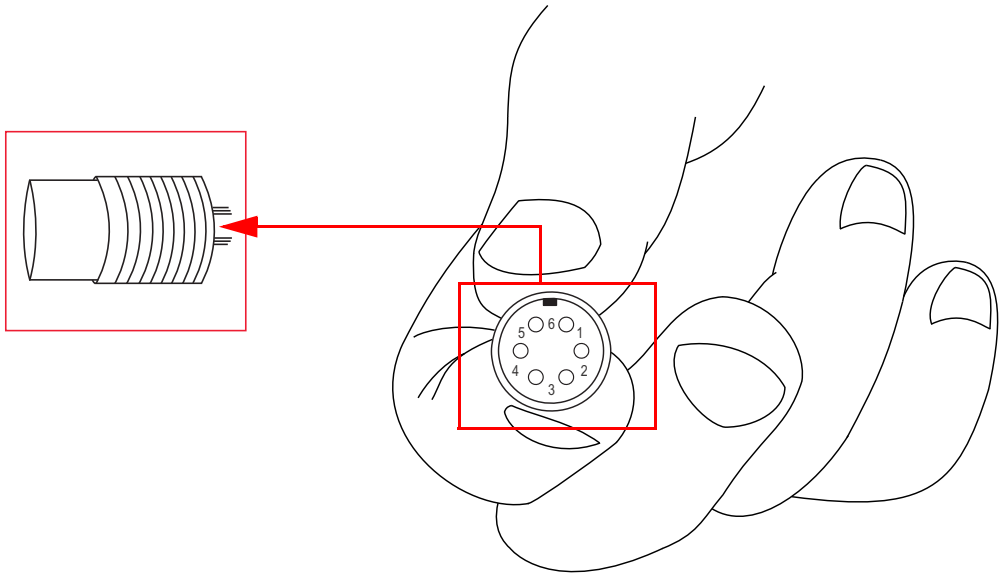


Figure 7-16 *Connector pinout outlook*

Note also that direction of pin numbering is done clockwise starting from the key at the upper edge of the inner part of the connector.

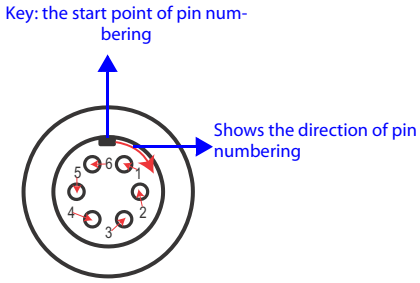


Figure 7-17 *The pin numbering direction*

When the soldering is done, insert the inner part of the connector in the main part.

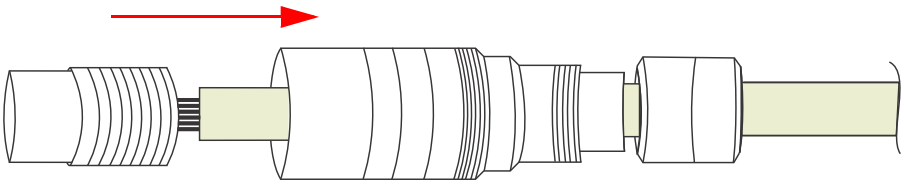


Figure 7-18 *Inserting of the inner part of the connector in the main part*

Screw in the inner part of the connector in the following way:

1. Fix the inner part of the connector with tweezers (see Figure 7-5 Fixing of the inner part of the connector with tweezers).
2. Hold the main part of the connector with fingers.

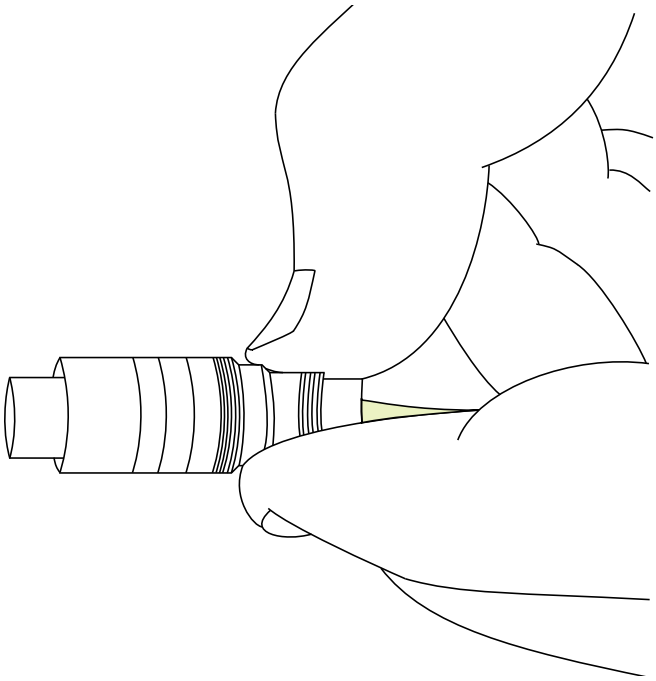


Figure 7-19 *Gripping of the main part of the connector with fingers*

3. Screw the main part of the connector in counterclockwise.

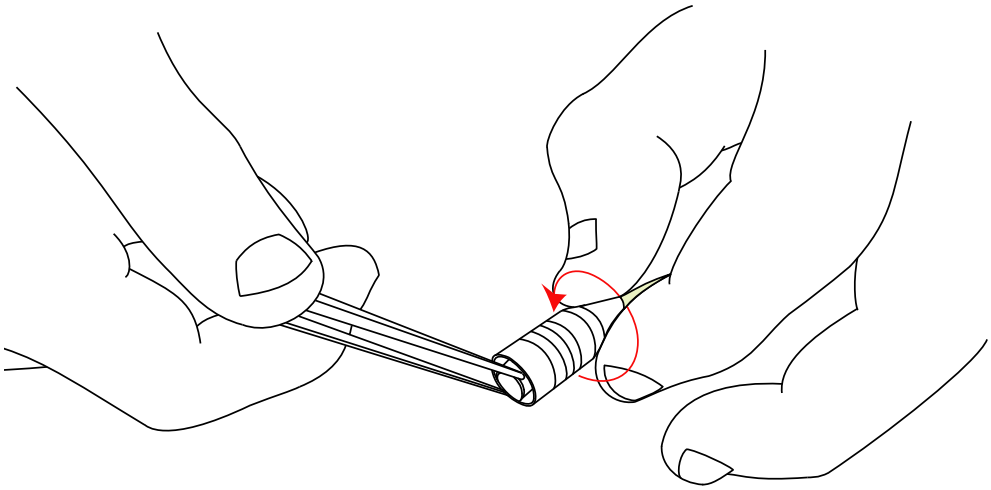


Figure 7-20 *Screwing the inner part of the connector in*

Insert the main part of the connector into the rear part.

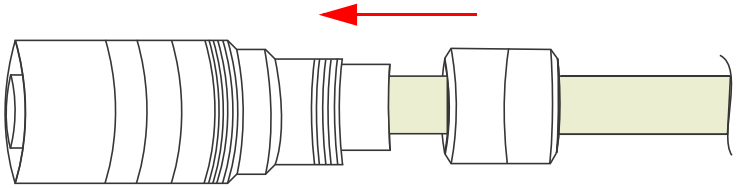


Figure 7-21 *Inserting of the main part of the connector into the rear*

Screw the rear part in using tweezers in the following way:

1. Fix the inner part of the connector with tweezers (see Figure 7-5 Fixing of the inner part of the connector with tweezers).
2. Screw the rear part of the connector in with your fingers counterclockwise.

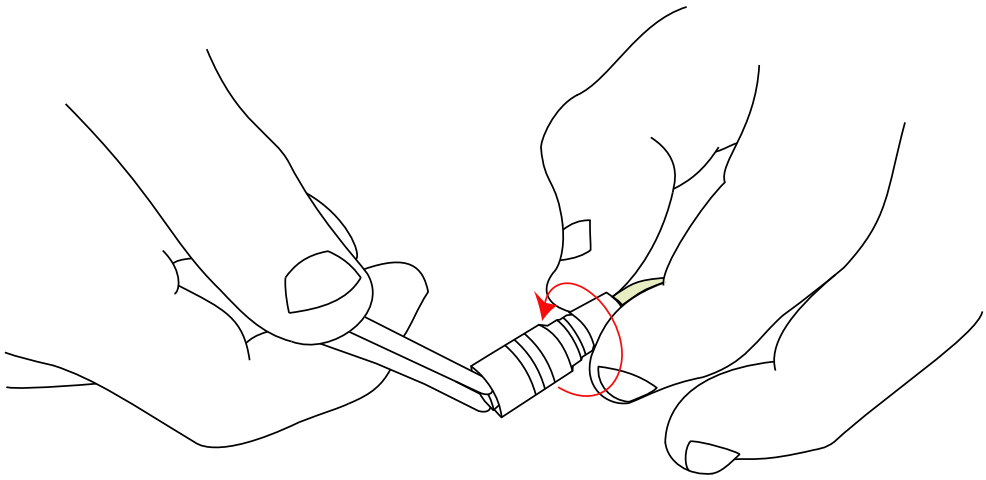


Figure 7-22 *Screwing of the rear part of the connector in to the main part*

Connector is ready to be used.

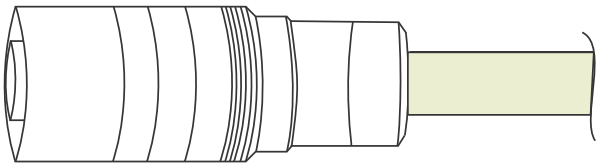


Figure 7-23 *Soldered connector with a cable*

Chapter 8

USE OF ACCESSORIES

SMX-12A2x Series cameras can be supplied with the following accessories:

1. C-mount adapter
2. C-mount adapter with IR-cut filter
3. Tripod adapter

This chapter will show you how to use the cameras with adapters.

Using C-mount Adapter with IR-cut Filter

The SMX-12A2Cx Series cameras can be a C-mount (with the adapter/adapter with filter) or a CS-mount (without the adapter/adapter with filter).

IR-cut Filter Characteristics

The IR-cut filter provided with the camera has the following characteristics:

- Diameter = 20mm
- Thickness = 2 mm

C-mount

In this case, the camera is used with the C-mount adapter or with the C-mount adapter with IR-cut filter:

Using Adapter with Color Cameras. Since the SMX-12A2C color cameras are sensitive to IR-light, use the C-mount adapter with IR-cut filter for the color camera models to make colors of the image more realistic.

Many light sources, including the sun, emit infrared light, so the color camera in daylight will see a significant amount of infrared light without the IR-cut filter. As a result, strange, non-realistic colors appear.

Another reason for using the IR-cut filter is the limited color correction for many lenses. that have different depth of focus for the visible and infrared spectrum. The IR-cut filter cuts away a significant amount of the overall collected light and thereby affects the sensitivity in a negative way. In general, color cameras are one factor less sensitive compared to monochrome (depending on the sensor). This is primarily due to the IR-cut filter.

Using Adapter with Monochrome Cameras. SMX-12A2M monochrome cameras are more sensitive to infrared light than color models. Using the cameras in the environment rich for infrared light may result in highlighted images. To avoid this effect, use the C-mount adapter with IR-cut filter for monochrome cameras.

CS-mount

In this case, the camera is used without both C-mount adapter and C-mount adapter with IR-cut filter.

Converting the Camera from CS-mount to C-mount or from C-mount to CS-mount

- To use the SMX-12A2x camera as C-mount, screw the C-mount adapter/C-mount adapter with IR-cut filter in.
- To use the SMX-12A2x camera as CS-mount, screw the C-mount adapter/C-mount adapter with IR-cut filter out.

Note: *It is recommended to screw in (as well as screwing out) the C-mount adapter/C-mount adapter with IR-cut filter, lens or the camera's cover when the camera is facing down or when the camera is in horizontal position - to prevent the sensor contamination.*

Using Tripod Adapter

To put the tripod adapter on the camera:

1. Loosen the screw of the adapter.
2. Put the Tripod adapter on the camera. Locate the tripod on the camera.

To remove the tripod adapter from the camera:

1. Loosen the screw of the adapter.
2. Remove it from the camera.

Appendix 1

How to Watch Uncompressed Movie on Full Speed

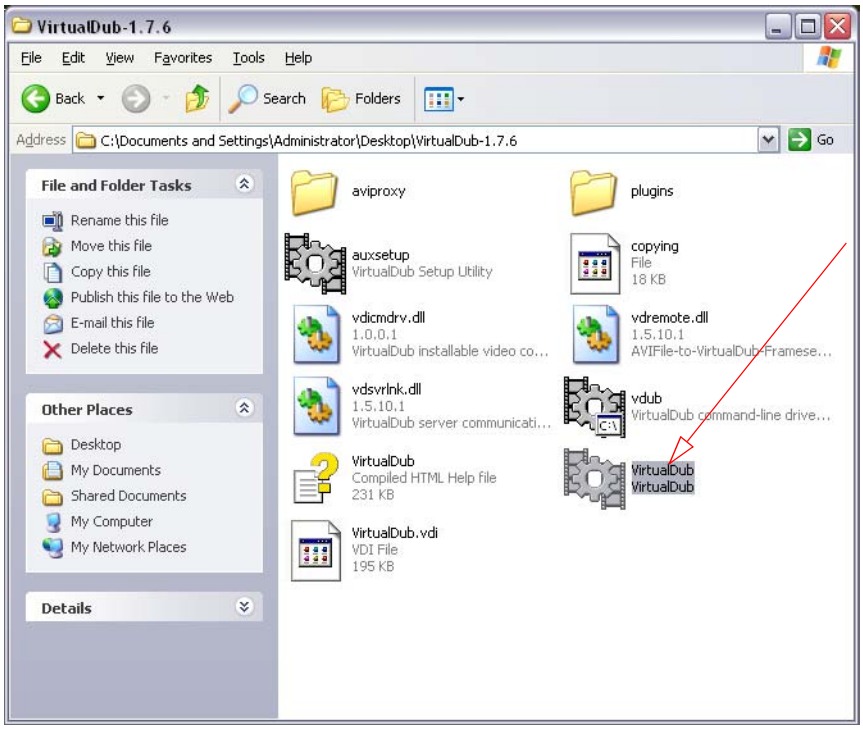
The SMX-12A2 Series camera and its software allow saving video with speed up to 60 fps. Most of common video players can not run such high-speed video. To watch the full speed video with its real speed, use special applications.

Below is an example of using such application - the **VirtualDub**.

Note: *VirtualDub is an open source software which can be downloaded free of charge. See its home page http://www.virtualdub.org/ for more details.*

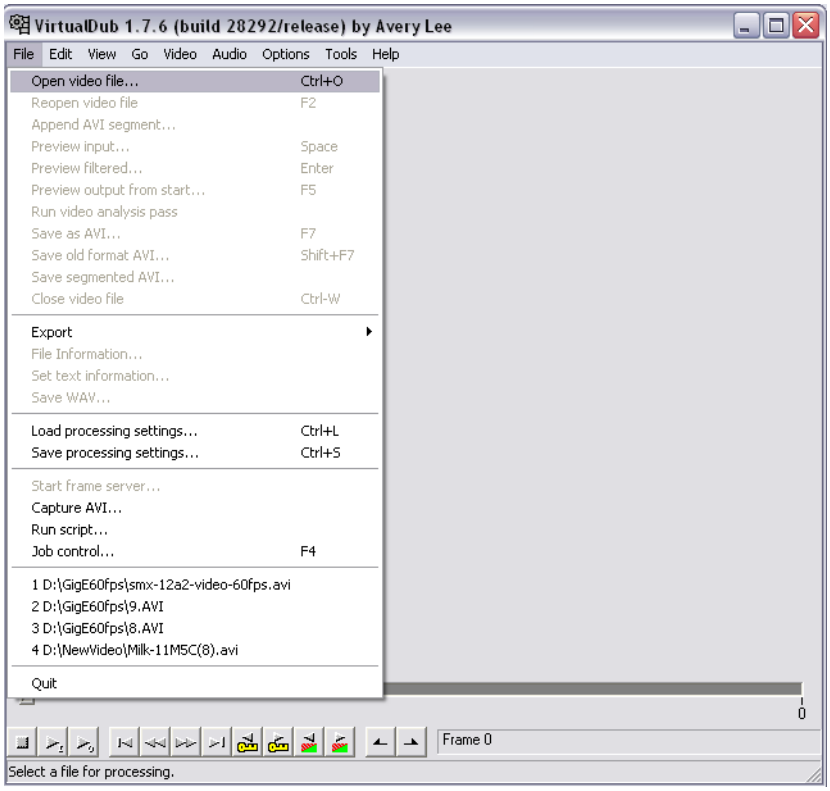
To run VirtualDub:

Browse to the folder where it was saved and run **VirtualDub.exe**.



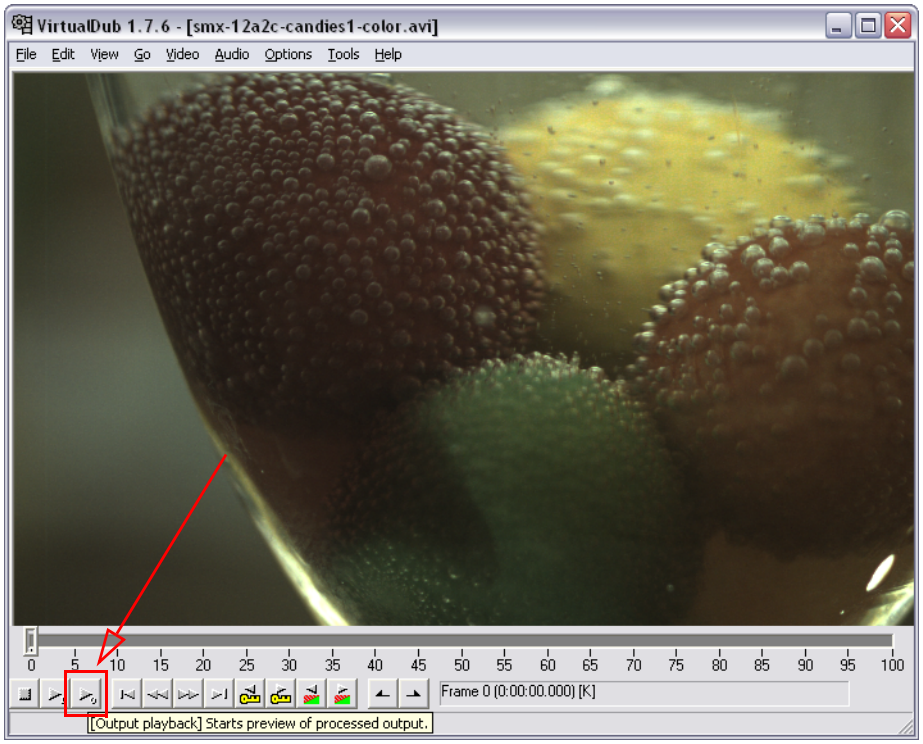
To open a video file in VirtualDub window:

1 Click **File** and select **Open video file**:

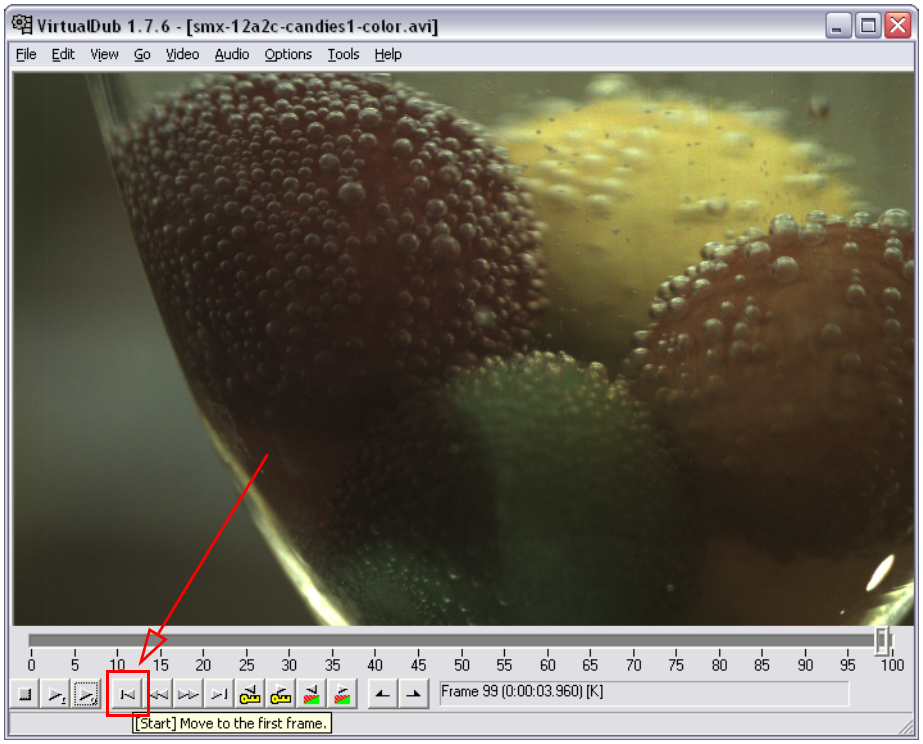


2 Browse for the captured video file which was saved.

3 Click the **Output Playback** button and wait till the video will reach the end. This video will be slow because the file is being cashed by the application:



4 When the first playback is finished, click the **Start** button (or press **Ctrl+Left Arrow**) to return to the first frame:



5 Now the video is ready for the normal playback. Click the **Output Playback** button to watch it.

Note: Each time when video file is opened, the first Output Playback will be slow.

Appendix 2

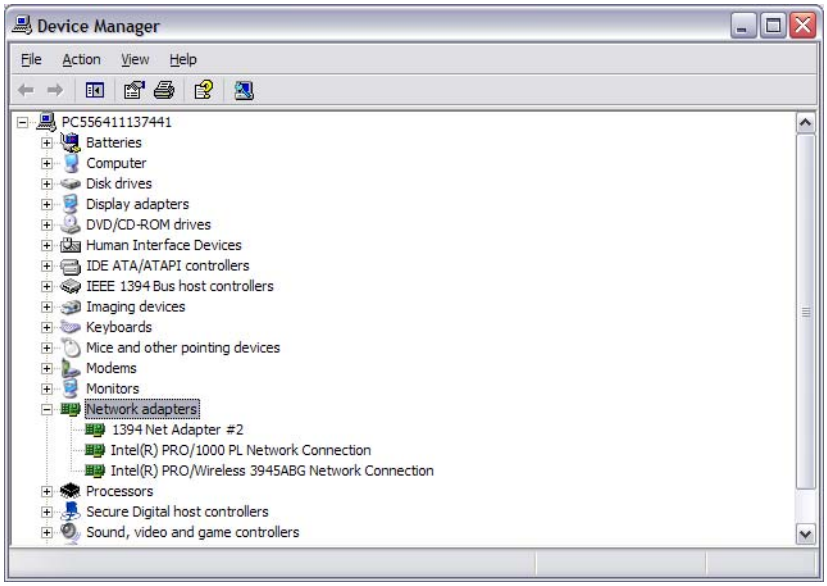
How to Determine Gigabit Ethernet Connection

The SMX-12A2x Series cameras have the Gigabit Ethernet interface which requires Gigabit Ethernet Adapter.

To determine whether your computer has a Gigabit Ethernet Adapter and whether it works properly:

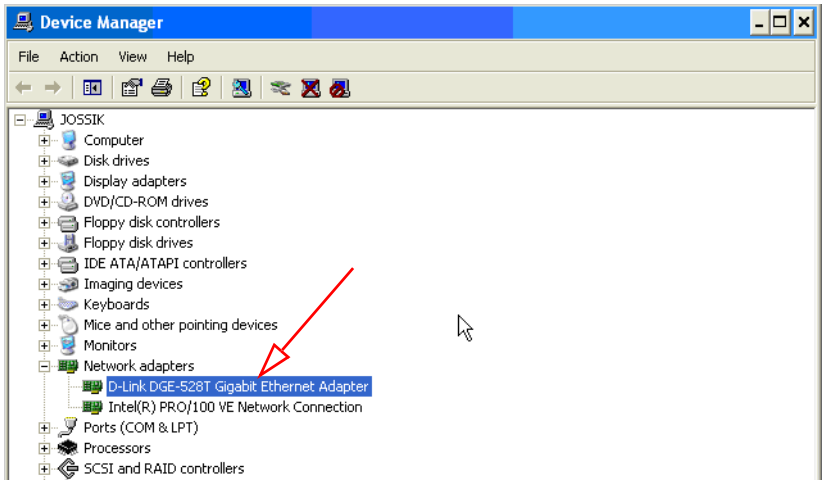
1 Open the **Device Manager** window.

2 In the **Device Manager** tree, find and expand the **Network Adapters** item:

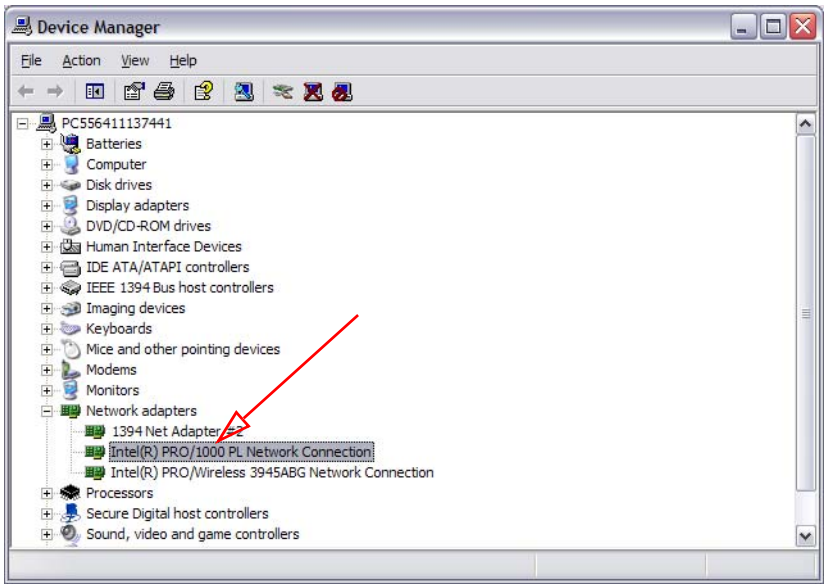


If your computer has **Gigabit Ethernet Adapter**, it will be displayed in tree:

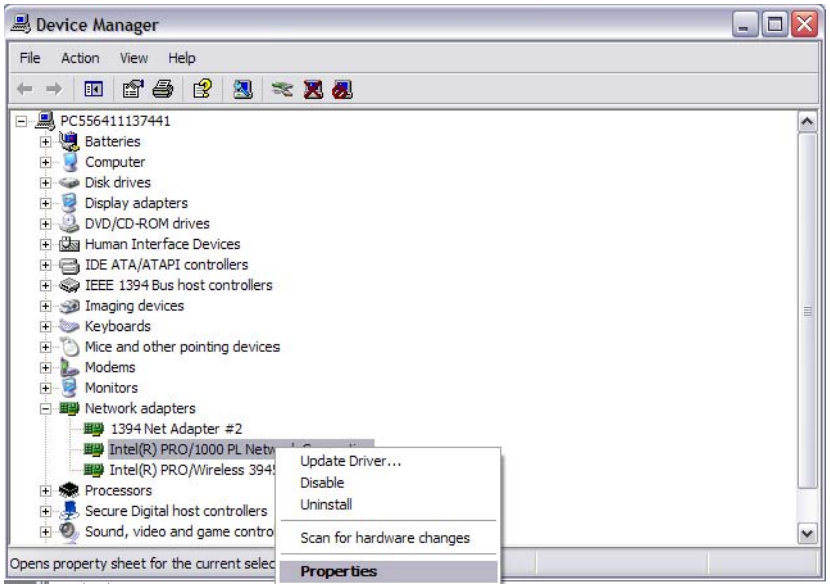
- The adapter name contains “Gigabit Ethernet”:



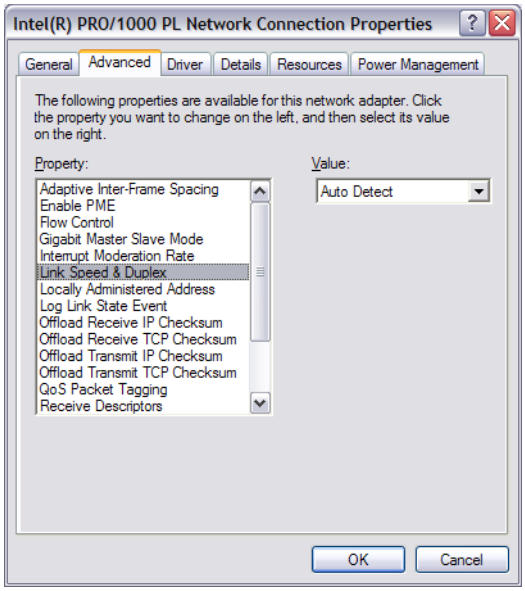
- The adapter name contains “1000”:



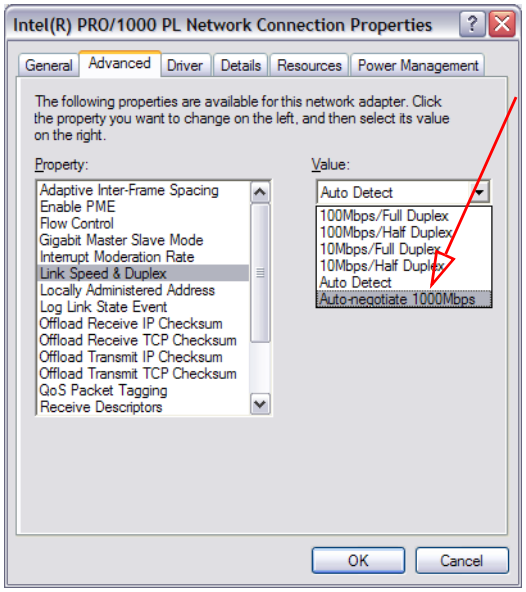
3 Right-click the adapter and select **Properties**:



4 In the **Network Connection Properties** dialog box that will open, select the **Advanced** tab and in the **Property** list, select **Link Speed & Duplex**:



5 In the **Value** drop-down menu, select a 1000 Mbps value:



Note: *If none of described above matches your Network Adapters, we recommend that you update it to suit the requirements.*

Appendix 3

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